**Bayero University, Kano**

**College of Health Science**

**Faculty of Allied Health Science**

**Department of Medical Radiography**

**B.RAD. Radiography**

**Proposed 30% addition to the CCMAS Course Structure /Summary**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **100 LEVEL** | | | | | |
| **Course Code** | **Course Title** | **Unit(s)** | **Status** | **LH** | **PH** |
| BUK-MTH 101 | Mathematics for Health Sciences | 3 | C | 45 | - |
| **TOTAL** | | **3** |  |  |  |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **200 LEVEL** | | | | | |
| **Course Code** | **Course title** | **Unit (s)** | **Status** | **LH** | **PH** |
| BUK-ANA 201 | General Histology | 2 | C | 15 | 45 |
| BUK-PIO 201 | Gastrointestinal tract and Renal Physiology | 2 | C | 30 | - |
| BUK-PIO 202 | Endocrinology & Reproductive Physiology | 2 | C | 30 | - |
| BUK-PIO 203 | Excitable Tissues, CNS, Special Senses Physiology | 2 | C | 30 | - |
| BUK-RAD 203 | Introduction to Radiography | 2 | C | 30 | - |
|  | **TOTAL** | **10** |  |  |  |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **300 LEVEL** | | | | | |
| **Course code** | **Course title** | **Unit (s)** | **Status** | **LH** | **PH** |
| BUK-ANA 301 | Gross Anatomy of Head and Neck | 3 | C | 30 | 45 |
| BUK-RAD 302 | Radiographic Technique (Lower Limb, Pelvis/Hip and vertebral Spine). | 2 | C | 15 | 45 |
| BUK-RAD 303 | Surface Anatomy for Radiographers | 2 | C | 15 | 45 |
| BUK-ANA 304 | Radiobiology, Dosimetry and Protection II | 2 | C | 30 | - |
| BUK-PTH 301 | General Pathology | 2 | C | 30 | - |
| BUK-PTH 302 | Systemic Pathology | 2 | C | 30 | - |
| BUK-RAD 306 | Radiographic Anatomy and Physiology II | 2 | C | 30 | - |
| BUK-RAD 305 | Medical Jurisprudence for Radiographers | 2 | C | 30 | - |
|  | **TOTAL** | **17** |  |  |  |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **400 LEVEL** | | | | | |
| **Course Code** | **Course title** | **Unit (s)** | **Status** | **LH** | **PH** |
| BUK-RAD 402 | Interventional Radiography | 2 | C | 30 | - |
| BUK-RAD 403 | Echocardiography and ECG | 2 | C | 30 | - |
| BUK-RAD 404 | MRI, Nuclear Med., and Thermography | 2 | C | 30 | - |
| BUK-RAD 405 | Mammography (clinical applications and Complex techniques) | 2 | C | 30 | - |
| BUK-RAD 407 | Veterinary Radiography | 2 | C | 30 | - |
| BUK-GST 401 | Character Building, Professionalism and Team Work in Healthcare | 2 | C | 30 | - |
|  | **TOTAL** | **12** |  |  |  |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **500 LEVEL** | | | | | |
| **Course Code** | **Course title** | **Unit (s)** | **Status** | **LH** | **PH** |
| BUK-RAD 501 | Ultrasound–II (Protocols and Clinical Applications) | 3 | C | 30 | 45 |
| BUK-RAD 503 | CT II (Protocols and Clinical Applications) | 3 | C | 45 | - |
| BUK-RAD 505 | Quality Assurance in Radiography | 2 | C | 30 | - |
| BUK-RAD 506 | Forensic Radiography | 2 | C | 30 | - |
| BUK-RAD 507 | Industrial Radiography | 2 | C | 15 | 45 |
|  | **TOTAL** | **12** |  |  |  |
|  | **GRAND TOTAL** | **54** |  |  |  |

**Bayero University, Kano**

**Faculty of Allied Health Science**

**Department of Medical Radiography**

**B.RAD. Radiography**

**BUK-MTH 101 Elementary Mathematics for Health Sciences (3 Units, Core, LH 45)**

**Senate – approved relevance**

Training of well-skilled graduates that can apply the knowledge gained in Elementary mathematics for generating and presenting data, analyzing problems involving integration, differentiation using different methods and evaluate simple biostatical problems in other related courses. This is consistent with the university's vision and mission of providing leadership in research and education in Africa which is intended to develop graduates who are effective communicators, critical thinkers, and skilled at integrating evidence into practice.

**Overview**

The course examines the elementary set theory, subsets, union, intersection, complements, venn diagram, real numbers and integers. This course will cover rational and irrational numbers, real sequences, series, and theory of quadratic equations, binomial theorem, circular measures, and trigonometric functions of angles of any magnitude.

Students will also learn how to evaluate quadratic equations and trigonometric functions,analyse problems involving rational and irrational numbers, Real sequences and solve mathematical problems in other related courses. Additionally, students will learn how to solve simple biostatical problems in other related courses. The objectives of the course, learning outcomes, and contents are provided to address this need.

**Objectives:**

**The objectives of the course are to:**

1. Identify and solve problems involving Set, Subset, Union, Intersection, Complements and use of Venn diagrams
2. Solve Quadratic equations and trigonometric functions
3. Solve problems in trigonometry involving angles of any magnitude
4. Analyze problems involving rational and irrational numbers, Real sequences and series
5. Solve Binomial theorem and circular measure
6. Solve mathematical problems in other related courses.

**Learning Outcomes**

On completion of the course, students should be able to:

1. Identify and solve three problems involving Set, Subset, Union, Intersection, Complements and use of Venn diagrams
2. Solve quadratic equations and trigonometric functions
3. Solve problems in trigonometry involving angles of any magnitude
4. Analyze problems involving rational and irrational numbers, Real sequences and series
5. Solve Binomial theorem and circular measure
6. Solve mathematical problems in other related courses.

**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.

**Minimum academic Standards**

As available in the NUC MAS

**Bayero University, Kano**

**Faculty of Allied Health Science**

**Department of Medical Radiography**

**B.RAD. Radiography**

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

### Senate approved relevance

Training of highly qualified graduates that can appropriately apply the knowledge gained of the basic histology of cells and tissues as essential guides to understanding of underlying causes of most disease conditions that are usually encountered in the day-to-day practice of Radiographers. This is in line with mission of Bayero University Kano of addressing African development challenges through cutting-edge research, knowledge transfer, and the training of high-quality graduates

### Overview

Understanding the basic histology cells and tissues is important for intending radiographers. More specifically, the knowledge of the histology of connective tissues, blood, bone, muscles and nervous tissue are very important to the field of medical imaging and radiation therapy.

The essence is to ensure that students are able to understand the clinical implication of some hematological, neurological, musculoskeletal and oncological diseases and to effectively evaluate and manage such cases as part of multidisciplinary health team. The objectives of the course, learning outcomes, and contents are provided to address this need:

### Objectives of the Course

The objectives of the course are to:

1. Explain methods of histology and cytology
2. Explain differential centrifugation
3. Describe histological methods and be able to explain principles of microscopic analysis of X ray diffraction
4. Describe epithelium-classification, structural features, specialization, function blood formed elements of blood, Blood cell formation and bone marrow
5. Identify the connective tissues, Histogenesis and histophysiology
6. Identify muscular tissue, types of muscle, chemistry, molecular basis of muscular contraction, histogenesis and regeneration of muscular tissues.
7. Explain the nervous: structure, types and distribution, peripheral nerve endings, neuroglia, synapse and the relationships of nervous tissue
8. Describe the structure of the blood vascular system, fine structure of the capillary wall (arteries and veins), heart, lymphatic vessels, nodes histogenesis and regeneration
9. Describe the thymus- Histological organization functions, involution of thymus, Mammary Gland, Resting and Active Functions-endocrine control, regression and involution of mammary gland,
10. Describe the Reproductive system (Male &Female) Urinary system

### Learning Outcomes

On completion of the course, the students should be able to:

1. Carry out the common histological and cytological methods.
2. Describe differential centrifugation and its uses
3. Illustrate the principles of microscopic analysis
4. Explain epithelial classification, the various structures,
5. Demonstrate connective tissue sections and the various structures
6. Explain muscular tissue, types, chemistry, molecular contraction, and regeneration of muscular tissues.
7. Describe the nervous tissue structure, indicating the various structures and their distributional differences
8. Illustrate the blood vascular system, structures of the capillary wall, heart, lymphatic, nodes
9. Analyze the thymus tissue histologically, their organization, functions, mammary tissue., resting and active functions of endocrine control
10. Demonstrate the structures and specializations of the tissues of reproductive system (male and female)

### 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, Classification, Chemistry, Regeneration, Regressive change in Cartilage, Histophysiology. The Bone classification. 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).

### Minimum Academic Standards

This is in line with what is available in the NUC MAS requirement.

**Bayero University, Kano**

**Faculty of Allied Health Science**

**Department of Medical Radiography**

**B.RAD. Radiography**

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

### Senate approved relevance

This course empowers graduates with the training and knowledge which they can apply in providing excellent Radiography care, diagnosis and management to patients, and are capable of handling chronic non communicable diseases and acute complications such as autonomic dysreflexia triggered by constipation, bowel impaction or appendicitis; This in-line with the mission of Bayero University Kano of addressing African development challenges through cutting edge research, knowledge transfer, and the training of high-quality graduates.

**Overview**

Understanding gastrointestinal problems in the patients receiving medical imaging is of utmost important. The essence is for students to understand the physiology behind exercise induced gastrointestinal distress.

To understand gastrointestinal disorders triggering abrupt uncontrolled life-threatening increase in blood pressure (autonomic dysreflexia) in patients with spinal cord injury who are undergoing rehabilitation and to appreciate that low back pain in some patients may not be purely a musculoskeletal issue but could be referred from peptic ulcer or stomach cancers. Students are to understand impact of psychological eating disorder such anorexia and bulimia nervosa on patient undergoing radiological investigations. The objectives of the course, learning outcomes, and contents are provided to address this need.

This course teaches the functions of the renal system of human body at a level required for clinical medicine and basic research in medical physiology. The course covers physiology, as well as selected diseases. Concepts are taught using a combination of lectures, research assignments, and case reports. The ultimate goal is for students to develop an understanding of the integrated functions of the normal body and “problem solving” and “critical thinking” skills in evaluating clinical situations.

### Objectives of the Course

The objectives of the course are to:

1. Explain the functions of the structures of GIT,
2. Explain the neural and humoral control autonomic innervations of the GIT both

(Sympathetic and parasympathetic Gastro-intestinal reflexes)

1. Discuss the various types of movements in the GIT (propulsive and mixing humoral control of GIT motility), mastication
2. Discuss functions of saliva, salivary gland and salivary reflexed,
3. Explain the functions and structures of the stomach, mechanisms of mixing and propulsion of food in the stomach
4. Discuss gastric secretion: Composition, properties and functions of gastric juice. And its regulation.
5. Explain vomiting ayodenum: Composition, properties and functions of pancreatic juice, effects and factors, which modify it Nervous influences.
6. Discuss the functions of the liver, Composition, properties and functions of bite bile ejection, regulation of bile production
7. Explain mechanism of gall bladder emptying. Gall stones
8. Discuss types of intestinal digestion, Uniqueness of intestinal secretion of enzymes small intestine, intestinal and an intestinal inhibitory reflex; gastro-intestinal reflex.
9. Explain the relevant structures of the kidney such as renal cortex, renal medulla, medullary pyramids, renal artery, renal vein and ureter; the nephron; the physiology of urine formation; Regional Differences in Nephron structure: cortical and juxtamedullary Nephrons.
10. Describe functions of the kidney in Excretion of Metabolic wastes, Regulation of water, electrolyte balances; regulation of body fluid osmolality and electrolyte concentrations. Regulation of acid base balance, Regulation of arterial blood pressure.
11. State the renal handling of K+, Na+, Fe, vitamins, carbohydrates, proteins and lipids; and Renal Failure and chronic kidney disease
12. Discuss the functions of the kidneys
13. Explain the functional unit of the kidney, regional differences, cortical and juxtamedullary nephrons
14. Discuss the physiology of urine formation and mechanism of urine concentration counter current mechanism

### Learning Outcomes

On completion of the course, the students should be able to:

1. Discuss the functions of the structures of GIT,
2. Elaborate the neural and humoral control autonomic innervations of the GIT both

(Sympathetic and parasympathetic Gastro-intestinal reflexes)

1. State the various types of movements in the GIT (propulsive and mixing humoral control of GIT motility), mastication
2. Explain the functions of saliva, salivary gland and salivary reflexed,
3. List the functions and structures of the stomach, mechanisms of mixing and propulsion of food in the stomach
4. Discuss gastric secretion: Composition, properties and functions of gastric juice. And its regulation.
5. Explain vomiting ayodenum: Composition, properties and functions of pancreatic juice, effects and factors, which modify it Nervous influences.
6. Highlight the functions of the liver, Composition, properties and functions of bite bile ejection, regulation of bile production
7. State the mechanism of gall bladder emptying. Gall stones
8. Discuss types of intestinal digestion, Uniqueness of intestinal secretion of enzymes small intestine, Intestino intestinal and an intestinal inhibitory reflex; gastro-intestinal reflex.
9. State the functions of the kidneys
10. Highlight the functional unit of the kidney, regional differences, cortical and juxtamedullary nephrons
11. Explain the physiology of urine formation and mechanism of urine concentration counter current mechanism.
12. Discuss the functions of the kidneys
13. Explain the functional unit of the kidney, regional differences, cortical and juxtamedullary nephrons
14. Discuss the physiology of urine formation and mechanism of urine concentration counter current mechanism

### Course Content

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 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.

**Bayero University, Kano**

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**Department of Medical Radiography**

**B.RAD. Radiography**

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

### Senate approved relevance

The endocrine system produces hormones that are instrumental in maintaining homeostasis and regulating reproduction and development. The reproductive system in males and females reflects a highly dynamic underlying physiology. Yet our current understanding of this system is still largely based upon relatively simplistic snapshots of individual component cells and tissues. This in-line with the mission of Bayero University Kano of addressing African development challenges through cutting-edge research, knowledge transfer, and the training of high-quality graduates

### Overview

This course delves into the fascinating ways in which hormones influence the body's development and function. Initial lectures describe the nature of different hormones and how they exert their actions. Subsequent lectures explore how hormones regulate body functions including growth and reproduction, thyroid and metabolism, calcium and bones, nutrition, and salt/fluid balance. Clinical examples from both health and disease as well as evolutionary and historical perspectives are used liberally to illustrate points.

The course will also explore how this physiology can be used to understand and treat diverse medical disorders such as diabetes, infertility, abnormal sexual differentiation and puberty, and osteoporosis. This course also discusses the role of hormones in regulating reproduction in mammals, with an emphasis in humans. Topics to be covered include: 1) sexual differentiation of the brain, 2) spermatogenesis and oogenesis, 3) pregnancy, parturition, and lactation, and 4) fertility and sexually transmitted diseases. Background in anatomy and physiology is recommended

### Objectives of the Course

The objectives of the course are to:

1. Discuss the hypothalamic factors that control the secretion of each of the anterior pituitary hormones and their association with the anterior pituitary;
2. State the anterior pituitary hormones, their synthesis and relationships
3. Explain the posterior pituitary lobes (cell types, vascular supply and anatomic functions)
4. Discuss the stages in biosynthesis, storage and secretion of T3 and T4 and their regulation
5. Explain the role of parathyroid hormone secretion
6. State the hormonal influence of the pancreas, cells, origin, chemical and physiological actions
7. Explain the hormones secreted from each zone of the adrenal glands
8. Explain the role and uses of glucocorticoids
9. Discuss mineralocorticoids and state their biological actions and target organs or tissues
10. Explain catecholamines
11. Explain the mechanisms for developmental changes in the male and female reproductive systems
12. Highlight the physiological functions of the major components of the male reproductive tract
13. Explain the synthesis, transport, metabolism and elimination of testosterone.
14. Discuss the roles of FSH, LH, estradiol, and inhibin in oogenesis and follicular maturation;
15. Discuss the cellular mechanisms of oestrogen and their actions
16. Discuss the cellular mechanisms of progesterone and other progestins;
17. Discuss the development and physiological functions of the placenta
18. Explain the neuroendocrine regulation of milk secretion and milk ejection
19. Highlight the physiological justification of the steroid hormone contraception

### Learning Outcomes

On completion of the course, the students should be able to:

1. List the hypothalamic factors that control the secretion of each of the anterior pituitary hormones and describe their route of transport from the hypothalamus to the anterior pituitary;
2. List the 3 major families of the anterior pituitary hormones and their biosynthetic and structural relationships;
3. Describe the posterior pituitary lobes with respect to cell types, vascular supply, development, and anatomical function relative to the hypothalamus;
4. Identify the steps in the biosynthesis, storage, and secretion of tri-iodothyronine (T3) and thyroxine (T4) and their regulation;
5. Describe the regulation of parathyroid hormone secretion and the role of the calcium sensing receptor;
6. Identify the major hormones secreted from the endocrine pancreas, their cells of origin, chemical nature and physiological actions;
7. List the functional zones (one medullary and three cortical zones), innervation, blood supply, principal hormones secreted from each zone of the adrenal glands;
8. Identify the major physiological actions and therapeutic uses of glucocorticoids;
9. List the major mineralocorticoids and identify their biological actions and target organs or tissues; and
10. Identify the chemical nature of catecholamines, their biosynthesis, mechanism of transport within the blood, and how they are degraded and removed from the body.
11. Describe developmental changes in the male and female reproductive systems, including the mechanisms responsible for these changes, during in utero development, and in childhood through puberty;
12. List the physiological functions of the major components of the male reproductive tract;
13. Discuss the biosynthesis, mechanism of transport within the blood, metabolism and elimination of testosterone and related androgens;
14. List the causes and consequences of over-secretion and under-secretion of testosterone for a) prepubertal and b) postpubescent males;
15. Explain the roles of FSH, LH, estradiol, and inhibin in oogenesis and follicular maturation;
16. List the actions and cellular mechanisms of estrogens;
17. List the actions and cellular mechanisms of progesterone and other progestins;
18. Describe the development and the major physiological functions of the placenta;9. discuss the neuroendocrine regulation of milk secretion and milk ejection; and
19. Explain the physiological basis of steroid hormone contraception.

### Course Content

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.

### Minimum Academic Standards

In line with NUC MAS with equipment and kits necessary for illustrating course objectives.

**Bayero University, Kano**

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**Department of Medical Radiography**

**B.RAD. Radiography**

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

### Senate approved relevance

Special senses of sight, hearing, taste and smell are the communicating channels between the body and the world outside. Apart from being necessary for a normal daily living, they also act as gates for knowledge and pleasure. For Bayero University Kano to achieve its mission and vision of providing cutting edge research and leadership in Africa and beyond, this course remains a priority to providing its graduates with the needed knowledge necessary to connecting ones internal environment with the outside world.

### Overview

The special senses consist of the senses of sight, hearing, taste and smell. The sense organs are located in the head and have connections with the brain. These senses allow the individual to detect and analyze light, sound and chemical signals in the environment. Since the vestibular apparatus is part of the ear in which the hearing apparatus is located, vestibular functions will also be covered in this section even though they are not strictly special senses.

This course is designed to deliver adequate knowledge to Radiography graduates on the normal processes and functions of the of eye, ear , human body tissues (General histology) and embryo development (general embryology) The vision (the eye), hearing and balance (the ear, which includes the auditory system and vestibular system) will be covered within Anatomy of the special senses, integrating anatomy with histology and embryology. This course includes lectures and laboratory experiences in the study of the auditory and visual systems, it will provide foundational knowledge for students destined to undertake advanced studies in anatomy and physiology, and will develop analytical laboratory skills.

### Objectives of the Course

The objectives of the course are to:

1. Explain the steps in excitation-contraction coupling in skeletal muscle
2. Draw and describe the structure of the neuromuscular junction
3. Explain the intracellular factors that can cause muscle fatigue
4. Explain the steps in the excitation-contraction coupling mechanism in cardiac muscle and compare with skeletal muscle including different mechanisms for sarcoplasmic reticulum calcium release.
5. Explain how the resting membrane potential is generated
6. Illustrate mechanisms of action potential propagation along both non-myelinated and myelinated axons
7. Explain the disorders that can occur at the neuromuscular junction.
8. Describe the gross structure of the eye and basic physiological optics;
9. Explain the processing of information in the visual cortex and the consequence of a lesion in the higher visual association areas;
10. Illustrate the mechanical structures involved in sound detection;
11. Draw a diagram of the auditory pathways including all central connections;
12. Explain the location, structure, and afferent pathways of taste receptors and taste centers;
13. Explain the location, structure, and afferent pathways of smell receptors
14. Describe the olfactory receptors are activated and the mechanism of olfactory transduction.

### Learning Outcomes

On completion of the course, the students should be able to:

1. list the steps in excitation-contraction coupling in skeletal muscle;
2. describe the structure of the neuromuscular junction;
3. list some intracellular factors that can cause muscle fatigue;
4. describe the distinguishing characteristics of multi-unit and unitary smooth muscles;
5. explain the steps in the excitation-contraction coupling mechanism in cardiac muscle and compare with skeletal muscle including different mechanisms for sarcoplasmic reticulum calcium release;
6. explain how the resting membrane potential is generated
7. state the Nernst equation, and indicate how this equation accounts for both the chemical and electrical driving forces that act on an ion;
8. discuss the mechanisms by which an action potential is propagated along both nonmyelinated and myelinated axons;
9. describe the principle of the voltage clamp and how it is used to identify the ionic selectivity of channels; and
10. discuss the disorders that can occur at the neuromuscular junction.
11. describe the gross structure of the eye and basic physiological optics;
12. draw a diagram of the retino-thalamo-cortical pathways;
13. describe the pupillary light reflex and its diagnostic value;
14. discuss the processing of information in the visual cortex and the consequence of a lesion in the higher visual association areas; list the mechanical structures involved in sound detection;

### 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.

### Minimum Academic Standards

A minimum lecture hall capacity for 50 students with a projector and availability of the wireless network. Well-spaced physiology laboratory with adequate equipment in line with NUC\_MAS. Physiology kits such as Neuroscience kit, EEG kit and tools, AC/DC differential amplifier, intracellular amplifier, nerve chamber, alga chamber, audio monitor and analog stimulus isolator.

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**B.RAD. Radiography**

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

### Senate approved relevance

The training of Radiography students without knowledge of the history of how the profession came to being will be inadequate. It is important that the students understand how events in the past led to where we are today. Lessons learnt especially from the mistakes during the discovery of x rays and those from the founding fathers of the profession, especially in Nigeria will instill into the students a sense of appreciation and respect for the profession. This is consistent with the university's vision and mission of providing leadership in research and education in Africa while also addressing African development challenges through cutting-edge research, knowledge transfer, and the training of high-quality graduates.

**Overview**

This course is designed to expose students to the history of Radiography. The course will also educate the students to know the contributions of great men and women that contributed to the development of Radiography as a profession in Northern Nigeria, Nigeria, Africa and the world at large. History of Radiography education in Nigeria as well as Northern Nigeria will be discussed, this will help in building a sense of belongingness in the students as also appreciate the commitment and sacrifices of many individuals who are currently gone.

The course shall apply basic concepts learnt in radiation physics and apply them physically in clinically both in practice and daily life. Introduction to basic concepts to radiation protection in the clinical settings, image presentation format, technical aspects of a radiographic image, principles of image formation, introduction into projection in radiograpy, differences between a view and radiography. Image processing concepts and methods, their advantages and disadvantages.

### Objectives of the Course

The objectives of the course are to:

1. Discuss the discoverer of x-rays, state the place and date of the discovery, and describe the discovery.
2. State the pioneers in the development of radiography and describe their contributions.
3. Highlight the history and development of radiography education.
4. Describe the characteristics of matter and energy.
5. Discuss the various forms of energy.
6. Define electromagnetic radiation and specifically ionizing radiation.
7. State the relative intensity of ionizing radiation from various sources.
8. Become familiar with all aspects of modern radiography and how it relates to patient care
9. Introduce basic positioning principles and practices
10. Introduce the processes of analysis, critical thinking and problem solving
11. Prepare students to be proficient in all phases of radiography clinical under the supervision of clinical faculty.
12. Prepare the student for clinical experience on patients in the hospital environment.
13. Explain the concepts of basic radiation protection.
14. Highlight and define units of radiation and radioactivity.

### Learning Outcomes

On completion of the course, the students should be able to:

1. Explain the discoverer of x-rays, state the place and date of the discovery, and describe the discovery.
2. Name the pioneers in the development of radiography and describe their contributions.
3. Summarize the history and development of radiography education.
4. Describe the characteristics of matter and energy.
5. Identify the various forms of energy.
6. Define electromagnetic radiation and specifically ionizing radiation.
7. State the relative intensity of ionizing radiation from various sources.
8. Explain all aspects of modern radiography and how it relates to patient care
9. Discuss basic positioning principles and practices
10. Analyze the processes of analysis, critical thinking and problem solving
11. Discuss all phases of radiography clinical under the supervision of clinical faculty.
12. Develop the clinical experience on patients in the hospital environment.
13. Explain the concepts of basic radiation protection.
14. List and define units of radiation and radioactivity.

### Course Content

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. Nature of our 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.

**Minimum Academic Standards**

A minimum lecture hall capacity for 50 students with a projector and availability of wireless network necessary for illustrating course objectives.

**Bayero University, Kano**

**Faculty of Allied Health Science**

**Department of Medical Radiography**

**B.RAD. Radiography**

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

### Senate approved relevance

It is key for the Radiography graduate to be familiar with the anatomy of the head and neck in order to have an adequate understanding of the conditions that could affect the structures they encompass and principally understand the medical images they primarily generate before the physician of radiologist make and contribution. In patient management especially at emergency circumstances, on the spot impression matters in directing the course of management. Similarly, the gradual digitization of the medical processes and growing popularity and application of complex imaging modalities such as CT and MRI which have the highest application in neuroimaging makes this course paramount. This is consistent with the university's vision and mission of providing leadership in research and education in Africa while also addressing African development challenges through cutting-edge research, knowledge transfer, and the training of high-quality graduates. This is in line with the mission and vision of the University.

### Overview

This course aims to give a solid grounding in the gross anatomical structure and function of the head and neck. The module also aims to develop your teaching skills in a number of different ways that could be demonstrated to patients during practice.

The student will be introduced to the neck and all the structures it envelops, the main vascular supply to the contents of the cranial vault, the orbit and its contents, the teeth and how they are developed, the muscles of the face, the cartilaginous structures of the face, and the external, middle and inner ear.

### Objectives of the Course

The objectives of the course are to:

1. Introduce anatomical concepts related to the head and neck region.
2. Explain the terminologies, topography and morphology of osteological structures of the head and neck
3. Explain the brain and its major deeper structures
4. Explain major musculoskeletal elements of the face, ear, nasal cavity , pharynx, larynx, oral cavity and cervical regions
5. Discuss the major vessels which supply the structures of the head and neck
6. Explain in detail the course of the facial and cranial nerves.

### Learning Outcomes

On completion of the course, the students should be able to:

1. Explain the key anatomical concepts of the structures of the head and neck.
2. Discuss terminologies and most osteological structures of the head and neck
3. Describe the structure of the brain and its major deeper structures
4. Identify major musculoskeletal elements of the skull, face, ear, nasal cavity, pharynx, larynx, oral cavity, and cervical regions.
5. Identify the major blood vessels which supply the features of the head and neck; and
6. Describe in particular the course and distribution of the facial and trigeminal cranial nerves.

### 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.

### Minimum Academic Standards

Specified course objectives in line with NUC MAS.

**Bayero University, Kano**

**Faculty of Allied Health Science**

**Department of Medical Radiography**

**B.RAD. Radiography**

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

### Senate approved relevance

Training graduates with appropriate and relevant knowledge and skills in taking independent actions when carryout Radiographic examinations of the spine, pelvic girdle and the lower limb. As different patients present with varying complications and restrictions necessary to carrying out a successful radiographic examination. The course equips graduates with recent and newer proven techniques of handling complex situations of achieving results while patient safety is not compromised This is consistent with the University's vision and mission of providing leadership in research and education in Africa while also addressing African development challenges through cutting-edge research, knowledge transfer, and the training of high-quality graduates.

### Overview

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 radiography and those requiring supplementary views for patients at any stage of the life span.

Specifically, radiographic projections for Vertebral column (cervical, cervico-thoracic. thoraco-lumber), pelvic girdle, hip and lower limb will be provided to the students in such detail that each student will have confidence in all techniques required.

### Objectives of the Course

The objectives of the course are to:

1. Discuss the terminologies and special radiographic considerations given when carrying out x-ray examinations of the vertebra,
2. Discuss the terminologies and special radiographic considerations when carrying out x-ray examinations of the pelvic girdle,
3. Explain the radiographic considerations when carrying out x-ray examinations of the hip
4. Illustrate the terminologies and special radiographic considerations when carrying out x-ray examinations of the lower limb.
5. Analyze the indications for carrying out x-ray examinations of the vertebra, pelvic girdle, hip and lower limb.
6. Highlight the step by step procedure for the basic projections of the vertebra, pelvic girdle, hip and lower limb.
7. Highlight the justification and step by step procedure for supplementary/ additional projections of the vertebra, pelvic girdle, hip and lower limb.
8. Describe patient preparations, radiation protection and exposure factors consistent with production of high-quality radiographs of the vertebra, pelvic girdle, hip and lower limb.
9. Describe the accessories used for each of the projections of the vertebra, pelvic girdle, hip and lower limb.
10. Criticize the radiographs of the vertebra, pelvic girdle, hip and lower limb.

### Learning Outcomes

On completion of the course, the students should be able to:

1. Explain the terminologies and special radiographic considerations when carrying out x-ray examinations of the vertebra,
2. Discuss the terminologies and special radiographic considerations when carrying out x-ray examinations of the pelvic girdle,
3. Illustrate the radiographic considerations when carrying out x-ray examinations of the hip
4. Explain the terminologies and special radiographic considerations when carrying out x-ray examinations of the lower limb.
5. Discuss the indications for carrying out x-ray examinations of the vertebra, pelvic girdle, hip and lower limb.
6. Explain the step-by-step procedure for the radiographic projections of the vertebra, pelvic girdle, hip and lower limb.
7. Describe the justification and step by step procedure for supplementary/ additional projections of the vertebra, pelvic girdle, hip and lower limb.
8. Describe patient preparations, radiation protection and exposure factors consistent with production of high-quality radiographs of the vertebra, pelvic girdle, hip and lower limb.
9. Describe the accessories used for each of the projections of the vertebra, pelvic girdle, hip and lower limb.
10. Criticize the radiographs of the vertebra, pelvic girdle, hip and lower limb.

### Course Content

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).

**Minimum Academic Standards**

In line with NUC MAS plus a well-equipped demonstration laboratory capable of accommodating 20 students for practical demonstration of protocols and utilization accessories taught in the cause. Anatomical models, images, gadgets and equipment manipulation with hands-on supervision.

**Bayero University, Kano**

**Faculty of Allied Health Science**

**Department of Medical Radiography**

**B.RAD. Radiography**

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

### Senate approved relevance

Surface anatomy deals with anatomical features that can be studied by sight without dissection. Today’s methods of clinical practice is geared towards reducing invasive techniques to the least minimum while offering the highest form of care. This is consistent with the University's vision and mission of providing leadership in research and education in Africa while also addressing African development challenges through cutting-edge research, knowledge transfer, and the training of high-quality graduates.

### Overview

Surface anatomy (superficial anatomy and visual anatomy) is the study of the external features of the body which could be used as reference landmarks for important internal structure. The human body is fascinating and complex. These are the form and proportions of the human body and the surface landmarks which correspond to deeper structures hidden from view, both in static pose and in motion. In addition, the science of surface anatomy includes the theories and systems of [body proportions](https://en.wikipedia.org/wiki/Body_proportions) and related artistic canons.

The study of surface anatomy is the basis for depicting the human body in classical [art.](https://en.wikipedia.org/wiki/Art) This course can help you learn in a way that is helpful, fun appreciative and difficult to forget. The course will guide graduates through palpating various body regions and identifying the surface anatomy. This is what is applicable in the daily life of Radiographer providing care to his/her patients.

Objectives of the Course

The objectives of the course are to:

1. Introduce anatomical and Radiographic terminologies
2. Illustrate anatomical position and body planes
3. Introduce the anatomic lines and planes used in radiographic positioning and their relationships
4. Discuss the landmarks seen in the head and neck and their corresponding internal structures.
5. Discuss the landmarks in the thorax and abdomen and their corresponding internal structures.
6. Discuss the landmarks in the pelvic girdle and their corresponding internal structures.
7. Discuss the landmarks in the lower limb and their corresponding internal structures. **Learning Outcomes**

On completion of the course, the students should be able to:

1. Explain the anatomical and Radiographic terminologies
2. Discuss the anatomical position and body planes
3. Explain the anatomic lines and planes used in radiographic positioning and their relationships 4. Explain the landmarks seen in the head and neck and their corresponding internal structures.
4. List the landmarks in the thorax and abdomen and their corresponding internal structures.
5. Explain the landmarks in the pelvic girdle and their corresponding internal structures.
6. Explain the landmarks in the lower limb and their corresponding internal structures.

### 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.

**Minimum Academic Standards**

A minimum lecture hall capacity for a minimum of 50 students with a projector and availability of the wireless network. A well-equipped demonstration laboratory capable of accommodating 20 students for practical demonstration of anatomical topography using anatomical models, images and gadgets.

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**Bayero University, Kano**

**Faculty of Allied Health Science**

**Department of Medical Radiography**

**B.RAD. Radiography**

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

### Senate approved relevance

This aims to further enrich graduates of Radiography who will always be directing ionizing radiation to patients to have an extensive understanding of the biological effects of Radiation at the cellular level, the different quantification methods and possible protection measures. This is consistent with the University's vision and mission of providing leadership in research and education in Africa while also addressing African development challenges through cutting-edge research, knowledge transfer, and the training of high-quality graduates

### Overview

The course reviews the concepts relating to the effects of radiation on normal tissues and effects on malignant cells. The course also includes significant detail regarding cell cycle effects, cell signal induction, and molecular aspects germane to radiotherapy and its effects on tissue.

The course will provide fundamental knowledge of the mechanisms and biological responses of human beings to ionizing and non-ionizing radiations through the study of the effects of radiation on biological molecules, cells, and man including cancer and mutagenesis. The course will develop the ability to make objective decisions regarding the relative risks and benefits of radiation use in a variety of applications

### Objectives

The objectives of the course are to:

1. Discuss direct and indirect interactions between radiation and cells.
2. Describe the molecular basis of cellular radiosensitivity.
3. Explain the influence of cell cycle, repair, repopulation and reoxygenation on tissue radiosensitivity.
4. Illustrate the components of a cell survival curve.
5. Illustrate clinical data, draw a cell survival curve.
6. Differentiate between cell survival curves of varying LET radiations, hypoxic and aerated cells as well as cell cycle phases.
7. Explain the acute and late effects of radiation on living tissue.
8. Discuss the effects of whole-body radiation.
9. Discuss the long-term effects of radiation.
10. Explain the effects of radiation on the developing embryo and fetus at each stage.
11. Explain the effects of time, dose and fractionation on long term side effects and treatment effectiveness.
12. Discuss the relationship between LET, RBE and OER
13. Differentiate between the stochastic and nonstochastic defects of radiation exposure.
14. Explain the objectives of a radiation protection program.
15. Discuss radiation and radioactivity units of measurement.
16. Discuss dose equivalent limits (DEL) for occupational and non-occupational radiation exposure.
17. Explain e the as low as reasonably achievable (ALARA) concept.
18. Explain the basis for occupational exposure limits
19. Highlight ionizing radiation sources from natural and man-made sources.
20. Highlight the legal and ethical radiation protection responsibilities of radiation workers.
21. Demonstrate the calculation for dose equivalent limits with reference to the National Council on Radiation Protection and Measurements (NCRP) reports.
22. Discuss the theory and operation of radiation detection devices.

### Learning Outcomes

On completion of the course, the students should be able to:

1. Describe direct and indirect interactions between radiation and cells.
2. Describe the molecular basis of cellular radio sensitivity.
3. Explain the influence of cell cycle, repair, repopulation and reoxygenation on tissue radio sensitivity.
4. Describe the components of a cell survival curve.
5. Discuss clinical data, draw a cell survival curve.
6. Differentiate between cell survival curves of varying LET radiations, hypoxic and aerated cells as well as cell cycle phases.
7. Identify the acute and late effects of radiation on living tissue.
8. Describe the effects of whole-body radiation.
9. Describe the long-term effects of radiation.
10. Explain the effects of radiation on the developing embryo and fetus at each stage.
11. Explain the effects of time, dose and fractionation on long term side effects and treatment effectiveness.
12. Describe the relationship between LET, RBE and OER
13. Differentiate between the stochastic and nonstochastic defects of radiation exposure.
14. Explain the objectives of a radiation protection program.
15. Define radiation and radioactivity units of measurement.
16. Identify dose equivalent limits (DEL) for occupational and non-occupational radiation exposure.
17. Describe the as low as reasonably achievable (ALARA) concept.
18. Identify the basis for occupational exposure limits
19. Identify ionizing radiation sources from natural and man-made sources.
20. Enumerate the legal and ethical radiation protection responsibilities of radiation workers.
21. Calculate dose equivalent limits with reference to the National Council on Radiation Protection and Measurements (NCRP) reports.
22. Describe the theory and operation of radiation detection devices.

**Course Content**

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)

**Minimum Academic Standards**

In line with NUC MAS plus a demonstration laboratory capable of accommodating 20 students with radiation kits, for demonstration and radiation monitoring devices., energized x-ray equipment, radiation protection devices and sample tissues for demonstration.

**Bayero University, Kano**

**Faculty of Allied Health Science**

**Department of Medical Radiography**

**B.RAD. Radiography**

**BUK-PTH 301: General Pathology (2 Units, Core, LH=30, PH= 0)**

### Senate approved relevance

This course is introduced to train Radiography graduates who are equipped with a knowledge of effects of pathologic processes on the individual’s functional abilities and limitations due to pathological consequences. To provide foundational understanding at the cellular level of pathological basis of diseases. This will facilitate to effective diagnostic and therapeutic services of healthcare users in Africa and around the globe. This is consistent with the university's vision and mission of providing leadership in research and education in Africa while also addressing African development challenges through cutting-edge research, knowledge transfer, and the training of high quality graduates.

### Overview

Pathology investigates the essential nature of disease, especially changes in body cells, tissues, and organs that are caused by a disease condition. 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 are now a strong requirement for future health professionals working in a multi-disciplinary health set-up

**Objectives of the Course**

The objectives of the course are to:

1. Explain the essential basic pathological processes including cell death, cellular adaptation including injury, inflammation, healing and repair, immune and autoimmune diseases thrombosis and neoplasia
2. Discuss the relationships of basic pathological processes to the pathogenesis of common and important diseases.
3. Explain the predisposing factors, causes, pathogenesis, morphology and potential complications of such diseases.
4. Explain the clinical features of pathological conditions, their causes and mechanisms of disease.
5. Explain how pathological processes can be utilised in the investigation, management and prevention of disease.
6. Use the terminology for the field of pathology correctly and contextually.

**Learning Outcomes**

On completion of the course, the students should be able to:

1. Describe the basic pathological processes including cell death, cellular adaptation including injury, inflammation, healing and repair, immune and autoimmune diseases thrombosis and neoplasia
2. Acquire the ability to relate these essential basic pathological processes to the pathogenesis of common and important diseases.
3. List the predisposing factors, causes, pathogenesis, morphology and potential complications of such diseases.
4. Correlate clinical features with the causes and mechanisms of disease.
5. Explain how knowledge of pathological processes can be utilised in the investigation, management and prevention of disease.
6. Use the terminology for the field of pathology correctly and contextually.

### Course Content

Pathological mechanisms common to all tissue-cell pathology. Processes of cellular adaptation. Inflammation. Repair. Immunology. Cellular accumulation. Neoplasia. Principles of disease processes primarily related to cell damage. Cell adaptation. Cell reparation. Cell inflammation and the development of tumors. More detailed attention should be given to cardio and cerebrovascular pathology. Gastrointestinal diseases. Bone and joint diseases. Common cancers. This involves cellular responses to various stresses and stimuli, dynamics of the inflammatory process, circulatory and cell metabolism disturbances and neoplasia. Mechanisms of infection and immunopathological changes a

**Minimum Academic Standards**

As contained in the NUC-MAS

**Bayero University, Kano**

**Faculty of Allied Health Science**

**Department of Medical Radiography**

**B.RAD. Radiography**

**BUK-PTH 302: Systemic Pathology (2 Units, Core, LH=30, PH= 0)**

### Senate approved relevance

Students enter Medical School with a wide variety of educational needs and learning styles. In general, pathology students will learn the general concepts of etiology and pathogenesis, based on current and cutting-edge science, to understand cellular degeneration and death, organ failure and neoplasm. This is consistent with the university's vision and mission of providing leadership in research and education in Africa while also addressing African development challenges through cutting-edge research, knowledge transfer, and the training of high-quality graduates

### Overview

Pathology is one of the core lectures in medical school. Students are required to learn medical terminology of all diseases from head to toe and their definitions and concepts. Thus, pathology is a link between basic and clinical medicine. Systemic Pathology covers the morphologic features in various diseases.

It principally explains the epidemiology, etiology, pathogenesis, pathological changes, and clinic pathological relationship in combination with the cases. This course emphasizes on those body systems with direct impact on body systems and study of general pathology as a science & intrinsic component of Radiography training.

**Objectives of the Course**

The objectives of the course are to:

1. Explain all major concepts (keywords and phrases) of human diseases and the corresponding terminology,
2. Describe the pathogenesis and epidemiology of the common or important diseases
3. Classify the diseases based on its etiology and systems.
4. Discuss and recognize the major cell and tissue alterations associated with these diseases and how they contribute to organ dysfunction or clinical signs and symptoms.
5. Discuss how pathological analysis is used to recognize, classify, grade and stage the major types of malignancy.
6. Discuss how pathological analysis contributes to disease surveillance and the evaluation of therapeutic interventions.
7. Discuss the typical macroscopic and microscopic findings of all the major human diseases.

### Learning Outcomes

On completion of the course, the students should be able to:

1. Explain all major concepts (keywords and phrases) of human diseases and the corresponding terminology,
2. Describe the pathogenesis and epidemiology of the common or important diseases
3. Elaborate the diseases based on its etiology and systems.
4. Discuss and recognize the major cell and tissue alterations associated with these diseases and how they contribute to organ dysfunction or clinical signs and symptoms.
5. Discuss how pathological analysis is used to recognize, classify, grade and stage the major types of malignancy.
6. Discuss how pathological analysis contributes to disease surveillance and the evaluation of therapeutic interventions.
7. Discuss the typical macroscopic and microscopic findings of all the major human diseases.

### Course Content

The Course emphasizes "the language of disease" as a necessary foundation for self-education and lifelong learning. Pathology of diseases of the central nervous system. Pathology of diseases of the cardiovascular system. Pathology of diseases of the respiratory system; Pathology of diseases of the musculoskeletal system. Pathology of diseases of the endocrine and metabolic system; Pathology of diseases of the integumentary system; Pathology of diseases of the hematologic system; Pathology of diseases of the lymphatic system. Pathology of diseases of the gastrointestinal system. Pathology of diseases of the renal and urologic system; Infectious disease; Oncology; Transplantation; of the bone, identification of common pathological conditions and their imaging features, Fractures, types of fractures, bony pathologies and presentation eg Osteoporosis, osteomyelesia, osteopenia, osteoporosis, arthritis and neoplastic diseases of the bone. Pathologies of the Chest. Pathologies of the skull. Pathologies of the Pelvis. Pathologies of the Spine. Pathologies of the Abdomen and l Pathologies of the ower extremities with their radiographic presentation.

**Minimum Academic Standards**

A dedicated classroom adequate to accommodate 50 students with a projector and a wireless facility sufficient to effectively deliver to the students with models, images, slides and other accessories.

**Bayero University, Kano**

**Faculty of Allied Health Science**

**Department of Medical Radiography**

**B.RAD. Radiography**

**BUK-RAD 306: Radiographic Anatomy and Physiology II (2 Units, Core, LH=30, PH= 0)**

### Senate approved relevance

For an effective understanding and application of Radiography education. Students of radiography must be able to marry the gross anatomy they learnt in the faculty of basic medical sciences and apply to the patterns of Radiographic anatomy seen on various imaging modalities. It is only with this that proper appreciation, identification and diagnosis of pathological conditions can be made consistently. This is consistent with the university's vision and mission of providing leadership in research and education in Africa while also addressing African development challenges through cutting-edge research, knowledge transfer, and the training of high-quality graduates

### Overview

This is a hybrid course designed to develop the students’ ability to relate human anatomy and physiology to a radiographic image. This course continues with the Rad. Anat. I. The localization and identification of human anatomy on the radiographic image is emphasized. The course provides the study of the 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.

This course is designed to enable the third-year radiography student to integrate information learned from courses in radiographic positioning and anatomy into pathological processes diagnosed from radiographs and cross-sectional imaging options. Introduction to pathological concepts; Injury, inflammation, healing and repair; Immune system and autoimmune diseases; Commonly seen pathologies will be discussed and their radiographic appearance demonstrated. Course topics includes: Definition of Pathology, radiographic pathology across body systems, Identification of various pathological conditions

### Objectives of the Course

The objectives of the course are to:

1. Define/implement appropriate vocabulary, as well as recognize/discern anatomical structures by drawing, diagram, radiograph or specimen for future didactic and clinical application.
2. Discuss comprehensive knowledge of normal radiographic anatomy across body systems.
3. Discuss gross Radiographic anatomy and physiology of the skeleton from planar to cross-sectional radiographic images.
4. Describe the radiographic appearance, location, vertebral levels and anatomical relationships of major organs, vessels and structures of the brain and neck on planar and cross-sectional images
5. Discuss gross Radiographic anatomy and physiology of the reproductive system from planar to cross-sectional radiographic images.
6. Discuss gross Radiographic anatomy and physiology of the skeleton from planar to cross-sectional radiographic images.
7. Discuss gross Radiographic anatomy and physiology of the digestive system from planar to cross-sectional radiographic images.

### Learning Outcomes

On completion of the course, the students should be able to:

1. Implement appropriate vocabulary, as well as recognize/discern anatomical structures by drawing, diagram, radiograph or specimen for future didactic and clinical application.
2. Explain normal radiographic anatomy across body systems.
3. Highlight Radiographic anatomy and physiology of the skeleton from planar to cross-sectional radiographic images.
4. Illustrate the radiographic appearance, location, vertebral levels and anatomical relationships of major organs, vessels and structures of the brain and neck on planar and cross-sectional images
5. Explain the gross Radiographic anatomy and physiology of the reproductive system from planar to cross-sectional radiographic images.
6. Explain the gross Radiographic anatomy and physiology of the skeleton from planar to cross sectional radiographic images.
7. Explain the gross Radiographic anatomy and physiology of the digestive system from planar to cross-sectional radiographic images.

### Course Content

This course revises basic human anatomy and physiology. The localization and identification of human anatomy on the radiographic image is emphasized. Skeletal anatomy and associated radiographic appearances Gross anatomy of the body systems and associated radiographic appearances Normal function of the skeleton and body systems. Anatomical locations and relationships of major organs and structures. Cross sectional anatomy at vertebral levels. Surface anatomy, vessels and pathways. Plain radiographic images CT images MRI images. Ultrasound images. 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.

Radiographic anatomy. Cavities that communicate with the pharynx. The process of deglutition/swallowing. The Oesophagus. Relations and functions. The process of swallowing and peristalsis in the oesophagus. 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.

**Minimum Academic Standards-**

A dedicated classroom adequate to accommodate 50 students with a projector and a wireless facility sufficient to effectively deliver to the students with models, images, slides and other accessories.

**Bayero University, Kano**

**Faculty of Allied Health Science**

**Department of Medical Radiography**

**B.RAD. Radiography**

**BUK-RAD 305: Medical Jurisprudence for Radiographers (2 Units, Core, LH=30, PH= 0)**

### Senate approved relevance

It is common for medical students to graduate from many developing nations without having a thorough understanding of medical ethics. Great strides have been made over time, and the complexity of medical issues has grown steadily more complex. Nigeria has to put more focus on the topic of medical ethics in the medical schools to familiarize aspiring radiographers with their main responsibility as radiographers in the course of their professional activity. Graduates needed to be acquainted with the theory of Laws (Jurisprudence) as our society becomes more and more conscious of their rights and entitlements. This is more so as Radiographers work with radiation which has become popular among societies as having detrimental effects. This is in line with the Bayero University’s mission and vision of purely addressing African developmental challenges through cutting edge research, knowledge transfer and training of high-quality graduates that will frontal confront the neglected societal issues as we attend to our clients. These will therefore address all forms of unethical issues through evidence- based radiography practices as captures in this course. This is consistent with the university's vision and mission of providing leadership in research and education in Africa while also addressing African development challenges through cutting-edge research, knowledge transfer, and the training of high-quality graduates

### Overview

This course is designed to introduce radiography students to principle of medical ethics and ethical issues in Nigeria, Crime and Ethics. Examples of legal and ethical dilemmas in medical practice. Laws of Torts. Morality and religion in radiography practice.

Students will also be taught the basic principle of ethics and their application, confidentiality, consent, and professional negligence. Licensing to practice. Basic knowledge of some national and international radiation regulations/ laws such as Nuclear Law and Safety, Nigerian Basic Ionizing Radiation Regulation, and Radiographers Registration Board of Nigeria Act.

### Objectives of the Course

The objectives of the course are to:

1. Define basic concept of medical law and ethics
2. Discuss the basic principle of ethics and their application, confidentiality, consent, and professional negligence.
3. Explain some basic national and international radiation regulations/laws.
4. Discuss the Radiographers Registration Board of Nigeria Act.
5. Discuss some medico legal Case studies.

### Learning Outcomes

On completion of the course, the students should be able to:

1. Define basic concept of medical law and ethics
2. Discuss the basic principle of ethics and their application, confidentiality, consent, and professional negligence.
3. Explain some basic national and international radiation regulations/laws.
4. Discuss the Radiographers Registration Board of Nigeria Act.
5. Discuss some medico legal Case studies.

### Course Content

Definition of the basic concept of medical law and ethics. Crime and Ethics. Examples of legal and ethical dilemmas in medical practice. Laws of Torts. Ethics. Morality and religion in radiography practice. The basic principle of ethics and their application. Maleficence/non-maleficence. Beneficence. Justice. Do no harm. Autonomy. Confidentiality. Consent, and professional negligence. Licensing to practice. Basic knowledge of some national and international radiation regulations/laws such as Nuclear Law and Safety, Nigerian Basic Ionizing Radiation Regulation, and Radiographers Registration Board of Nigeria Act. Case studies. Communication skills; trust; seeking to safeguard patients, particularly in respect to health and safety and information. Reputation. Fulfillment of professional role with integrity, restraining from its misuse to the detriment of patients, employers and colleagues.

**Minimum Academic Standards**

A dedicated classroom adequate to accommodate 50 students with a projector and a wireless facility.

**Bayero University, Kano**

**Faculty of Allied Health Science**

**Department of Medical Radiography**

**B.RAD. Radiography**

**BUK-RAD 402: Interventional Radiography (2 Units, Core, LH=30, PH= 0)**

### Senate approved relevance

The concept behind interventional radiology is to diagnose and treat patients using the least invasive techniques currently available in order to minimize risk to the patient and improve health outcomes. These procedures have less risk, less pain and less recovery time in comparison to open surgery. Radiographers constitute greater part of this prestigious medical team providing these services. This is in line with the mission of Bayero University Kano of addressing African development challenges through cutting-edge research, knowledge transfer, and the training of high-quality graduates, this course remains essential to this set vision.

### Overview

Interventional Radiography is a rapidly evolving specialty of radiology with specialist radiographers performing critical real time imaging whilst working with interventional radiologist treating patients.

The past few years have seen specialist interventional radiographers extending their practice by successfully training to perform interventional procedures too, a crucial role development to aid the interventional radiology workforce and keep up with the increasing expanding service demands.

### Objectives of the Course

The objectives of the course are to:

1. Describe various equipment used in interventional radiography
2. List the indications for interventional radiography procedures
3. List contraindication of interventional radiography procedures
4. Discuss patient preparation and technique in interventional radiography.
5. Provide clue in resolving equipment issues during interventional radiographic procedure.
6. Explain radiation safety in interventional radiography.

### Learning Outcomes

On completion of the course, the students should be able to:

1. Describe various equipment used in interventional radiography
2. List the indications for interventional radiography procedures
3. Enumerate the contraindication of interventional radiography procedures
4. Discuss patient preparation and technique in interventional radiography.
5. Resolve equipment issues during interventional radiographic procedure.
6. Explain radiation safety in interventional radiography.

### Course Content

Interventional radiography equipment. Procedures for vascular intervention. Indication for interventional radiography procedures. Contraindications of interventional radiography procedures. Positioning of patients in interventional radiography. Various Techniques deployed in interventional radiography. Resolving interventional radiography equipment issues. Radiation safety in interventional radiography. Patient care in interventional radiography. Seldinger Technique. Complications in interventional radiography. After care in interventional radiography. Non-vascular interventional radiology percutaneous biopsy (Percutaneous liver biopsy, Percutaneous kidney mass biopsy, percutaneous lung biopsy, thyroid gland biopsy, pancreas biopsy, bone biopsy. Percutaneous abscess drainage. Biliary interventions, PTC (percutaneous transhepatic cholangiography). Bile duct drainage, stent and balloon procedures. Radiofrequency ablation in bile duct tumors. Percutaneous cholecystostomy (Catheter placement in the gallbladder accompanied by ultrasound). Hydatic cyst treatment. Treatment in simple cyst of organs (liver, kidney, breast, thyroid). Urinary tract interventions: ureteral stenting (Stenting the urinary tract), external-internal ileo-uretero-nephrostomy. Procedures on veins: Treatment of arm and leg intravascular clots, varicose veins treatment methods, treatment of pulmonary veins clots (treatment in pulmonary embolism). Organ or tumoral embolization: embolization (Chemoembolization) in liver malignant tumors, chemoembolization in liver giant hemangiomas, fibroid embolization.

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**Minimum Academic Standards-**

A minimum lecture hall capacity for 50 students with a projector and availability of the wireless network. The equipment in Laboratory is in line with NUC MAS requirement.

**Bayero University, Kano**

**Faculty of Allied Health Science**

**Department of Medical Radiography**

**B.RAD. Radiography**

**BUK-RAD 403: Echocardiography and ECG (2 Units, Core, LH=30, PH= 0)**

### Senate approved relevance

The skill and knowledge required to perform and to interpret an echocardiogram are closely interlinked. Those whose primary task is to supervise echocardiographic studies and interpret the significance of the findings must also be trained and adequately skilled in performing the examinations so that they can judge the technical quality and reliability of the data. Conversely, the person performing echocardiographic studies must have not only technical and scanning ability but also must understand the clinical context of the examination. The nature of the disease or lesion dictates which specific views and examination techniques are needed. Comprehensive knowledge and skills in the field of echocardiography play a significant role in clinical decision making and diagnosis of various cardiovascular conditions. Adequate knowledge about echocardiography, its application, and interpretation aids in providing required care in cardiology units and ICUs. As a developing continent, we need to consolidate on this by ensuring competence in this respect. This is consistent with the university's vision and mission of providing leadership in research and education in Africa while also addressing African development challenges through cutting-edge research, knowledge transfer, and the training of high-quality graduates

### Overview

Echocardiography is a multimodality imaging technique with diverse individual techniques, showing established clinical value and promise in research. The full spectrum of echocardiography involves 2D, Doppler, transesophageal, and contrast echocardiograms. This course is not only designed to explain how to carry out echocardiography but also to emphasize its potential, application, and limitations.

The course provides necessary knowledge in the basic echocardiography principles, modes, application in various cardiovascular conditions, limitations, and potential. [Simulation Training On Basics of Percutaneous Coronary Intervention.](https://www.medvarsity.com/simulation-training-on-basics-of-percutaneous-coronary-intervention) [Basics of Mechanical and Non-Invasive Ventilation Simulation training.](https://www.medvarsity.com/courses/mechanical-and-non-invasive-ventilation-simulation-training) [AHA certified BLS+ACLS.](https://www.medvarsity.com/courses/simulation-training-on-bls-acls) Transesophageal and Transthoracic Echocardiography training using High-Fidelity Simulation. [Echocardiography Simulation Training.](https://www.medvarsity.com/courses/echocardiography-training) This course also equips students with the knowledge and skills necessary to conduct systematic ECG analyses of basic cardiac rhythms, and understand the diagnosis and treatment of arrhythmias in order to give the correct and immediate treatment to patients with arrhythmias.

### Objectives of the Course

The objectives of the course are to:

1. Build a step-by-step practical skill in conducting echocardiography
2. Explore the physical principles and artifacts of ultrasound to attain basic practical proficiency in B-mode and Doppler image optimization.
3. Demonstrate basic practical proficiency in performing and interpreting the goal directed echocardiography examination to differentiate between Normal anatomy & Physiology with pathology (left and right ventricular dimensions and function, right atrial dimensions and functions, interventricular and interatrial septum, A\_V valves, LVOT & RVOT,)
4. Demonstrate M-Mode acquisition and relationship to 2D cardiac anatomy
5. Explain segmental wall motion assessment, significant pericardial effusion and distinguish from pleural effusion
6. Explain gross abnormalities in valvular function
7. Discuss cardiac tamponade, acute pulmonary embolism, pneumothorax, pneumonia and pulmonary edema
8. Discuss the anatomy, physiology, and conduction system of the heart, a 12-lead ECG recording, and a bedside ECG monitor.
9. Set up and administer ECGs, stress tests, and monitors.
10. Explain the interpretation of the electrical activity and waves of an ECG.
11. Analyze an ECG systematically.
12. List the characteristics of basic arrhythmias
13. Recognize and correct artifacts.
14. Explain the basic cardiac rhythms and life-threatening cardiac arrhythmias.
15. Maintain ECG equipment and demonstrate lead placement.
16. Explain pacemaker rhythms on the ECG, and define the management of pacemaker malfunction.
17. Discuss the causes of cardiac arrhythmias.
18. Discuss the treatments for cardiac arrhythmias: drug therapy, defibrillation, synchronized electrical cardioversion,
19. Complete and document patient assessments

### Learning Outcomes

On completion of the course, the students should be able to:

1. Develop a step-by-step practical skill in conducting echocardiography
2. Discuss the physical principles and artifacts of ultrasound to attain basic practical proficiency in Bmode and Doppler image optimization.
3. Demonstrate basic practical proficiency in performing and interpreting the goal directed echocardiography examination to differentiate between Normal anatomy & Physiology with pathology (left and right ventricular dimensions and function, right atrial dimensions and functions, interventricular and interatrial septum, A\_V valves, LVOT & RVOT,)
4. Explain the M-Mode acquisition and relationship to 2D cardiac anatomy
5. Discuss segmental wall motion assessment, significant pericardial effusion and distinguish from pleural effusion
6. Describe gross abnormalities in valvular function
7. Describe the cardiac tamponade, acute pulmonary embolism, pneumothorax, pneumonia and pulmonary edema
8. Describe the anatomy, physiology, and conduction system of the heart, a 12-lead ECG recording, and a bedside ECG monitor.
9. Illustrate the set up and administer ECGs, stress tests, and monitors.
10. Explain the interpretation of the electrical activity and waves of an ECG.
11. Analyze an ECG systematically.
12. List the characteristics of basic arrhythmias
13. Describe how to Recognize and correct artifacts.
14. Explain the basic cardiac rhythms and life-threatening cardiac arrhythmias.
15. Describe the maintenance ECG equipment and demonstrate lead placement.
16. Explain pacemaker rhythms on the ECG, and define the management of pacemaker malfunction.
17. Explain the causes of cardiac arrhythmias.
18. Describe the treatments for cardiac arrhythmias: drug therapy, defibrillation, synchronized electrical cardioversion,
19. Describe a complete and document patient assessment

### Course Content

Basics and Principles (Introduction to Echocardiography, Cardiac Anatomy related to echocardiography, Basic physics of ultrasound, Principles of echocardiography, Transducers, Conventional echocardiography (TTE), Two dimensional and Motion-mode echocardiography, Principles of Doppler Echocardiography, Continuous Wave Vs Pulsed wave Doppler echo, Color Doppler Echocardiography). A systematic approach to echocardiography. Parasternal Long Axis Views. A systematic approach to echocardiography. Parasternal Short Axis Views. Systematic approach to echocardiography: Apical Views. Systematic approach to echocardiography: Subcostal and Suprasternal Views. Normal values and measurements. Contrast echocardiography. Myocardial deformation imaging. Tissue Doppler imaging. Transesophageal Echocardiography. Stress Echocardiography. Echocardiography in Specific Cardiac Condition (assessment of LV function and mass, Assessment of Pulmonary pressure. Assessment of pulmonary artery systolic pressure, Assessment of MPAP Assessment diastolic pulmonary artery pressure [DPAP], CAD: Segmental Assessment of LV Function and RWMA, Mechanical Complications of MI, Use of Newer modalities in CAD echo: Strain, strain rate.- 20 minutes) Dilated cardiomyopathy. Hypertrophic cardiomyopathy. Restrictive cardiomyopathy. ARVC Mitral valve diseases. Aortic valve diseases. Pulmonary valve diseases. Tricuspid valve diseases. Segmental Approach to congenital echocardiography. Echocardiography in infective endocarditis. Echocardiography in pericardial Diseases. Review the heart anatomy and physiology I relation to the electrical conducting system. The responsibilities when preparing a patient for and performing a 12-lead ECG. Systemic approach in analyzing basic ECG rhythms. Analyzing and identifying basic ECG rhythms propagated by various locations within the heart.

**Minimum Academic Standards-**

In line with NUC MAS in addition to a Laboratory with a dedicated ultrasound equipment with echo facility capable of accommodating 10 students which is connected to a flat screen television set for demonstration. The laboratory should also have a dedicated ECG equipment for demonstration.

**Bayero University, Kano**

**Faculty of Allied Health Science**

**Department of Medical Radiography**

**B.RAD. Radiography**

**BUK-RAD 404: MRI, Nuclear Med. And Thermography II (2 Units, Core, LH=30, PH= 0)**

### Senate approved relevance

This course will be training graduates with sufficient and relevant knowledge and skills to examine the human body using newer complex developed protocols and ideas with local African contemporary resources on MRI and nuclear medicine. The course will provide graduates with sufficient information and skills in the techniques and methods used to collect and analyze samples from the environment and regulations guiding radiopharmaceuticals. It will also acquaint our graduate with knowledge of thermography in the identification of peripheral vascular diseases, breast cancer and even diabetic neuropathy. Dermatological, heart, neonatal conditions can cheaply be evaluated using contemporary African contexts.

This is in line with the university's vision and mission of providing leadership in research and education in Africa while also addressing African development challenges through cutting- edge research, knowledge transfer, and the training of high-quality graduates.

### Overview

Magnetic resonance imaging (MRI) is a medical imaging technique that uses amagnetic field and computer-generated radio waves to create detailed images of the organs and tissues in your body. Thermography has been successfully used in diagnosis of breast cancer, diabetes neuropathy and peripheral vascular disorders. It has also been used to detect problems associated with gynecology, kidney transplantation, dermatology, heart, neonatal physiology, fever screening and brain imaging. This course deals with the physical and technical principles of the nuclear medical equipment.

The course also provides an advanced study in the fields of radiation physics and radiation protection in nuclear medicine. Further, the production and absorption mechanisms of the radiopharmaceuticals will be treated. Nuclear medicine uses radioactive material inside the body to see how organs or tissue are functioning (for diagnosis) or to target and destroy damaged or diseased organs or tissue (for treatment). Thermography has proved effective in the identification of peripheral vascular diseases, breast cancer, and diabetic neuropathy. It has also been used to identify issues with dermatology, heart, neonatal physiology, fever screening, and brain imaging. It has also been used to detect issues with gynecology and kidney transplantation.

### Objectives of the Course

The objectives of the course are to:

1. Discuss pre-procedural considerations.
2. Explain the positioning and patient setup, MR coils, equipment, table accessories and cushioning.
3. Explain step by step procedure of routine and special MRI examinations.
4. Explain the strength and weakness of applying different image contrast in different body regions.
5. Elaborate the standards protocols, policies and procedures regarding MR imaging and patient care.
6. Explain the systematic approach to evaluating and optimizing image quality.
7. Discuss the methods of Identifying and rectifying different types of MRI artifacts
8. Discuss the Diagnosis and therapy of Sealed and Unsealed sources. Route of administration of Radiopharmaceuticals.
9. Explain the concept of Thermography applications in breast cancer and spine blood flow.
10. Explain the technical structure and physical the background of the Gamma camera and the PET camera,
11. Explain the production and absorption mechanism of the radiopharmaceuticals.
12. Discuss the application of radiation protection regulations in connection with nuclear medical examinations.
13. Calculate the dose, complete and inject radiopharmaceuticals.
14. Discuss the application of current methodology in commonly occurring examinations within nuclear medicine.
15. Discuss cases on evaluation of a common nuclear medical studies.
16. Analyse a nuclear medical study in order to obtain a diagnostic understanding thereby. be familiar with structure and use of PET-CT.

### Learning Outcomes

On completion of the course, the students should be able to:

1. Identify pre-procedural considerations.
2. Position and setup patients, MR coils, equipment, table accessories and cushioning.
3. Perform routine and special MRI examinations.
4. Critically discuss the strength and weakness of applying different image contrast in different body regions.
5. Apply standards protocols, policies and procedures regarding MR imaging and patient care.
6. Evaluate and optimize image quality.
7. Identify and rectify different types of MRI artifacts
8. Discuss the Diagnosis and therapy of Sealed and Unsealed sources. Route of administration of Radiopharmaceuticals.
9. Explain the concept of Thermography applications in breast cancer and spine blood flow.
10. Describe the technical structure and physical the background of the Gamma camera and the PET camera,
11. Describe the production and absorption mechanism of the radiopharmaceuticals.
12. Apply radiation protection regulations in connection with nuclear medical examinations.
13. Calculate the dose, complete and inject radiopharmaceuticals.
14. Apply current methodology in commonly occurring examinations within nuclear medicine.
15. Present an evaluation of a common nuclear medical study.
16. Analyse a nuclear medical study in order to obtain a diagnostic understanding thereby. be familiar with structure and use of PET-CT.

### Course Content

Scheduling and sequencing of MR imaging procedures. Patient identification and verification of MRI request. Suite and equipment preparation. MRI examination of; brain, spine, abdomen, pelvis, joints, extremities, prostate, breast, cardiac MRI, MR angiography, pediatrics and whole-body MRI. Post processing images, Image quality analysis: Signal-to-noise ratio (SNR), Artifacts, Image storage. History of Radionuclide. Diagnosis and therapy of Sealed and Unsealed sources. Route of administration of Radiopharmaceuticals. Bone scan, thyroid scan, kidney, cerebral scan and myocardial perfusion. Safety sources and design of nuclear medicine facilities. The course deals with the physical and technical principles of the nuclear medical equipment. The course also provides an advanced study in the fields of radiation physics and radiation protection in nuclear medicine. Further, the production and absorption mechanisms of the radiopharmaceuticals will be treated. Complete, calculate dose, and inject radiopharmaceuticals. Carry out commonly occurring nuclear medical examinations. The placement in the gamma camera will imply that student is trained to plan, carry out and present commonly occurring examinations such as skeleton scintigraphy and renography. This also implies that the student during the course should create an understanding regarding nuclear medical reconstruction and diagnostic imaging. Shorter field studies on PET - CT are included in the course. Definition of thermography/heat therapy. Thermography applications in breast cancer. Thermography applications in spine blood flow. Magnetic resonance thermography. Digital Infrared Thermal Imaging (DITI). Diagnosis, detection and prognosis.

**Minimum Academic Standards**

A classroom with a capacity of accommodating 50 students having a projector and wireless facility.

**Bayero University, Kano**

**Faculty of Allied Health Science**

**Department of Medical Radiography**

**B.RAD. Radiography**

**BUK-RAD 405: Mammography (Clinical Application & Complex Techniques) (2 Units, Core, LH=45, PH= 0)**

### Senate approved relevance

Mammography is an advanced-level specialty imaging procedure that uses dedicated mammography equipment to produce low-dose, high contrast, and high-resolution images. It is the conventional modality of managing patients with breast lumps and cancer. The Nigerian and African population is suffering from this problem and in line with the mission of Bayero University Kano of addressing African development challenges through cutting-edge research, knowledge transfer, and the training of high-quality graduates, this course remains essential to this set vision.

### Overview

The goal of this course is to meet the needs of the patient by providing radiographers with the content knowledge and clinical skills to perform the tasks typically required of Mammo-Radiographer who are employed in the specialized area of mammography. In addition, it provides students with a comprehensive knowledge and understanding of the theoretical and clinical skills required to perform high quality mammograms while ensuring maximum patient care and confidence. Stereotactic breast biopsy procedures have been widely used for the definitive diagnosis of nonpalpable mammographically detected breast abnormalities for many years.

The stereotactic biopsy principle is that the exact location of a lesion within a breast can be identified through imaging and mathematical tools. This course teachers an overview of the breast stereotactic biopsy procedure and tomosynthesis guided biopsy, reviewing the requirements and technique, it uses a needle core biopsy which leaves minimal to no internal breast tissue scarring, which is often associated with open surgical biopsy. In comparison to open surgical biopsy, the procedure is less invasive, reducing complications and recovery time for the patient.

### Objectives of the Course

The objectives of the course are to:

1. Describe various equipment used in interventional radiography
2. List the indications for interventional radiography procedures
3. List contraindication of interventional radiography procedures
4. Discuss patient preparation and technique in interventional radiography.
5. Provide clue in resolving equipment issues during interventional radiographic procedure.
6. Explain radiation safety in interventional radiography.

### Learning Outcomes

On completion of the course, the students should be able to:

1. Describe various equipment used in interventional radiography
2. List the indications for interventional radiography procedures
3. Enumerate the contraindication of interventional radiography procedures
4. Discuss patient preparation and technique in interventional radiography.
5. Resolve equipment issues during interventional radiographic procedure.
6. Explain radiation safety in interventional radiography.

### Course Content

Epidemiology and principles of mammography, rationale for screening and screening processes, breast anatomy, physiology and pathology, mammography equipment and quality control procedures, radiation dose and risk, basic positioning techniques, specialised assessment views, imaging the difficult to position client, risk management strategies, artifact evaluation, indications for breast MRI, recognition of benign/malignant appearances, lesion localisation, processor operation and quality assurance, troubleshooting techniques, images and equipment, hormone replacement therapy, role of breast ultrasound, breast prosthesis, stereotaxis, management and treatment of breast disease, communication, patient relations and stress management, mammography equipment including emerging technologies, quality assurance and site quality control for digital mammography, digital mammography workshop, infection control procedures. Course provides the student with foundational concepts of mammographic equipment. It will include types and functions, factors that govern and influence image production and recording. Course provides the student with foundational concepts of mammographic quality assurance testing. This course will include factors that govern and influence quality control equipment. The student will gain the knowledge to construct a quality assurance program for a mammography program following the ACR and MQSA guidelines. The student will gain an understanding of various preoperative procedures such as a routine localization, specimen radiography, ultrasound of the breast, cyst aspiration, ductography, fine needle aspiration cytology, and breast MR. Course also includes minimally invasive needle breast biopsy procedures, core biopsy, stereotactic procedures, and interventional procedures used in breast cancer diagnosis.  Course provides the fundamentals of mammography positioning. It includes breast anatomy and physiology and pathologic changes, and the relevance of these to mammographic appearance and positioning including correlation to the radiographic appearance of normal anatomy and benign and malignant mammographic findings. The course also provides the basic concepts in patient assessment and evaluation in mammography. It includes effective communication, patient safety/comfort, patient preparation, professionalism, ethics and critical thinking. Course content will emphasize the importance of establishing a positive relationship with the patient, addressing their psychological needs and providing patient information related to the procedure. Procedure for stereotactic intervention. Procedure for tomosynthesis.

**Minimum Academic Standards-**

A lecture hall with a minimum capacity for 50 students having a projector and availability of the wireless network. Archives of mammographs, images, models and cases to be demonstra

**Bayero University, Kano**

**Faculty of Allied Health Science**

**Department of Medical Radiography**

**B.RAD. Radiography**

**BUK-RAD 407: Veterinary Radiography (2 Units, Core, LH=30, PH= 0)**

**Senate approved relevance**

Animal care is one of the core components of our endeavor that is neglected across almost all African boundaries. Dealing with the present realities of inadequate man-power and capabilities in almost all aspects of Radiography. This course intends to create an opening for graduates to potentially explore while at the same addressing the obvious component of animal care in Africa. This is in line with the university's vision and mission of providing leadership in research and education in Africa while also addressing African development challenges through cutting- edge research, knowledge transfer, and the training of high-quality graduates.

### Overview

Radiographic images help in creating treatment plans for common conditions like cardiac diseases and injury and tracking the response to treatment in various animals. The images enable more efficient medical management in veterinary medicine. They do that by supporting treatment planning.

This course will detail all aspects of veterinary radiography. Topics include the theoretical aspects of radiography, radiation safety, and patient handling techniques, taking, processing and evaluation of veterinary radiographs to ensure diagnostic quality. The technology enables more effective medical management. It helps veterinarians identify health problems without the need for diagnostic surgeries. The surgeries can cause complications to the animal.

### Objectives of the Course

The objectives of the course are to:

1. Explain the terminologies and principles of veterinary radiography
2. Explain the radiation protection and Safety Practices in veterinary radiography
3. Illustrate the positioning of companion animals for routine radiographic evaluations.
4. Explain the concept of storing, handling, labelling and processing veterinary radiographic film.
5. Explain how to perform regular checks and maintenance on veterinary accessory radiographic equipment.

### Learning Outcomes

On completion of the course, the students should be able to:

1. Discuss terminologies and principles of veterinary radiography
2. Explain the radiation protection and Safety Practices in veterinary radiography
3. Describe the position companion animals for routine radiographic evaluations.
4. Discuss the concept of storing, handling, labelling and processing veterinary radiographic film.
5. Discuss how to perform regular checks and maintenance on veterinary accessory radiographic equipment.

### Course Content

Terminology and principles of veterinary radiography. Radiation Safety and Safety Practices in veterinary radiography. Proper use of radiography equipment and accessories. Proper use and maintenance of personal protective equipment. Generation of veterinary radiographs for evaluation. Positioning techniques for small animals. Exposure variables and techniques. Radiographic studies of body regions. Specialized techniques for identification of specific conditions. Development, storage and handling of veterinary radiographs. Use of specialized screens and grids in veterinary radiography. Types and maintenance of veterinary radiography equipment. Care and maintenance of the veterinary radiography x-ray unit. Proper storage, maintenance and disposal of processing fluids in veterinary radiography.

**Minimum Academic Standards**

Availability of the wireless network and images for demonstrations are essential.

**Bayero University, Kano**

**Faculty of Allied Health Science**

**Department of Medical Radiography**

**B.RAD. Radiography**

**BUK-GST 401, Character Building, Professionalism and Team Work in Healthcare**

**(2 Units, Core, LH=30, PH= 0)**

**Senate approved relevance**

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| This course is designed in line with the vision and mission of the Bayero University, Kano to produce graduates that are highly qualified with excellent knowledge and high proficiency in skills capable of delivering excellent, respectful, empathic and culturally attuned healthcare services to society devoid of exploitation. The character, professional outlook as well as the work ethics of the graduates would be sharpened by the course to achieve this goal. This course would further strengthen the graduates to work as a team in the health sector to achieve the desired objectives. It should encourage individual members’ professional development through appropriate mentorship and character building. The course will discourage the development of the barrage of emerging 21st century societal vices inclusive of, but not limited to drug and substance abuse. In essence the course would entrench the humane and professional aspects of the graduates as they serve the society equipped with knowledge and skills consistent with the vision and mission of the Bayero University, Kano.  **Overview:** |
| A major life expectation of the graduates from this programme is the deployment of their services to a variety of clients including students, colleagues and vulnerable groups in the Nigerian milieu and beyond. Graduates of this programme, working with others, would also be expected to research into, propose, design and implement programmes, working with others, would research into, propose, design and implement policies and legislations in many areas of need to enhance better societal outcomes in health and education.  Accordingly, this course would prepare graduates from this programme to deploy their expertise in knowledge, skills, professionalism and work ethics in a culturally accepted manner, in the various services they offer to a variety of clients in healthcare, academia and other fields of endeavor.  In addition, the students will be exposed to communication and counselling skills that are consistent with the various cultural milieus of practice that they are likely to encounter. Furthermore, it will enhance the collaborative nature of the work they would be involved in post-qualification. The students would be exposed to nature of successful team work, appropriate leadership styles, mentorship and character-building skills and ways of refraining from societal vices such as drug and substance abuse.  **Objectives:**  The objectives of this course are to:   1. Describe various types of leadership styles applicable in clinical and academic settings. 2. Equip students with various skills of mentoring in clinical and academic settings. 3. Enumerate the characteristics of a successful team in achieving team objectives. 4. Describe the roles of professionalism in various fields of healthcare delivery. 5. Describe the principles and practice of psychology in healthcare settings. 6. Describe the principles of effective communication for the patients, healthcare team and the general public. 7. Discuss the essentials of successful character building for various personality traits. 8. Describe the general principles of ethics in medicine and health care research. 9. Identify the risk factors and preventive strategies for substance abuse.   **Learning Outcomes:**  At the end of the course, the students should be able to:   1. Identify at least three common types of leadership styles with two merits and demerits of each. 2. Discuss any two theories of leadership that could be applied in healthcare. 3. Identify at least three mentoring skills needed by all healthcare professionals. 4. Enumerate four attributes of a successful team. 5. Mention five circumstances where professionalism is required to meet client needs and expectations. 6. Discuss human behaviour and its application in health counselling. 7. Conduct three counselling sessions in three recognised clinical scenarios. 8. To demonstrate effective communication skills in dealing with clients, and the general public in recognised clinical scenario. 9. Enumerate four forms of character traits each for three personality types. 10. Mention four ethical challenges and four appropriate ethical principles to address them in a clinical practice and research. 11. Enumerate four preventive strategies to address three forms of drug abuse. |

**Course content:**

Concept of leadership and meaning of leaders. Theories, principles and styles of leadership. Methods of developing team wisdom. Team work as a personal skill. Creating powerful partnership in mentoring. Mentoring and mentoring skills: Stages of formal mentoring relationships. Introduction to professionalism in healthcare practice. Communication and interpersonal skills. Introduction to general psychology and medical psychology. Counselling psychology in applied psychology. Definition, principles and application of effective communication skills in healthcare settings. The principles of Character Building and types personality traits. Philosophical concepts of Character Building. Code of ethics and principles for various health professions. Case scenarios in health care and their ethical implications. Introduction to psychoactive substances and their clinical manifestations. Cultural perspectives and management strategies in psychoactive substance abuse.

**Minimum Academic standards requirements:**

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| A lecture hall with a minimum seating capacity of fifty students with a projector and flip chart. |
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**Bayero University, Kano**

**Faculty of Allied Health Science**

**Department of Medical Radiography**

**B.RAD. Radiography**

**BUK-RAD 501: Ultrasound-II (Protocols and Clinical applications) (3 Units, Core, LH=30, PH= 45)**

### Senate approved relevance

The course was developed to give students the knowledge and skills required and producing competent Radiographers that will effectively carry out ultrasound examination using simple developed protocols which will aid in addressing to widespread needs of our teeming population as it involves ultrasound examination. This will therefore address the negative indices of mortality and patient’s management to widespread conditions needing prompt and actual diagnosis of most of our common diseases. This is in line with the university's vision and mission of providing leadership in research and education in Africa while also addressing African development challenges through cutting- edge research, knowledge transfer, and the training of high-quality graduates.

### Overview

Technological advances in medical imaging have led to the development of high-tech radiology imaging devices that can produce better image visualization and better diagnostic outcome. The development of newer scanning protocols and advanced ultrasound equipment with 3D and $D capabilities requires our graduates to be exposed to this trend. The high frequency ultrasound probes provide better resolution in small and superficially seated tissues and organs.

The course will make candidates capable of handling clinical ultrasound and medical imaging process, recording exact anatomy that has been produced during the imaging process, writing reports based on scanning, conduct examinations of different patients using ultrasound techniques, facing challenges with a variety of patients having different ailments in the body, assisting other staff through the whole process and showing clinical competency.

### Objectives

The objectives of the course are to:

1. Discuss obstetric and gynecologic ultrasound examination under standardized protocols, pathologic patterns based on trimester, embryologic explanation and structural complications/patterns while correlating with clinical history and physical exam
2. Discuss abdominal ultrasound examination under standardized protocols, patient care, pathologic patterns based on tissue structural echogenicity and vascular changes and structural complications/patterns while correlating with clinical history and physical exam
3. Discuss abdominal ultrasound examination under standardized protocols and patient care emphasizing on the peritoneal, retroperitoneal, GIT, superficial and associated structures and their ultrasound patterns in both normal and pathologic conditions
4. Explain vascular sonographic examination under standardized protocols and patient care emphasizing on hemodynamics, waveform analysis, specifically on the carotid duplex/color flow imaging, upper and lower extremities arterial and venous duplex/color flow imaging and ankle brachial indices.
5. Discuss pediatric examination under standardized protocols and patient care emphasizing on the head, spine, hip, abdomen and urinary system. Including patient care and obvious restrictions
6. Introduce small parts ultrasound examination protocols and special requirements and patterns

### Learning Outcomes

On completion of the course, the students should be able to:

1. Explain obstetric and gynecologic ultrasound examination under standardized protocols, pathologic patterns based on trimester, embryologic explanation and structural complications/patterns while correlating with clinical history and physical exam
2. Explain abdominal ultrasound examination under standardized protocols, patient care, pathologic patterns based on tissue structural echogenicity and vascular changes and structural complications/patterns while correlating with clinical history and physical exam
3. Describe abdominal ultrasound examination under standardized protocols and patient care emphasizing on the peritoneal, retroperitoneal, GIT, superficial and associated structures and their ultrasound patterns in both normal and pathologic conditions
4. Describe vascular sonographic examination under standardized protocols and patient care emphasizing on hemodynamics, waveform analysis, specifically on the carotid duplex/color flow imaging, upper and lower extremities arterial and venous duplex/color flow imaging and ankle brachial indices.
5. Explain pediatric examination under standardized protocols and patient care emphasizing on the head, spine, hip, abdomen and urinary system. Including patient care and obvious restrictions
6. Highlight small parts ultrasound examination protocols and special requirements and patterns

### Course Content

Obstetrics and Gynecology Sonography - A continuation in the study of obstetrics & gynecology sonography to include pathologic, embryologic, and structural complications, clinical history, physical assessment, and the appropriate exam protocol. Abdominal Sonography I- A study of abdominal anatomy; physiology; patient care; and imaging/interventional techniques. Emphasis will be placed on normal and abnormal vascular, hepatic, biliary, splenic, and renal systems and associated sonographic patterns. Abdominal Sonography I- A continuation in the study of abdominal anatomy; physiology; patient care; and imaging/interventional techniques. Emphasis will be placed on normal and abnormal peritoneal, retroperitoneal, gastrointestinal, superficial structures and associated sonographic patterns. Vascular Sonography- A study of vascular anatomy, physiology, hemodynamics, wave form analysis, and treatment of vascular disease. Emphasis will be placed on carotid duplex/color flow imaging, upper and lower extremity arterial and venous duplex/color flow imaging, and ankle brachial indices. Including the clinical history, physical assessment, and appropriate scanning protocol. Pediatric Sonography - A study of neonatal and pediatric head, spine, hip, abdomen, and urinary systems anatomy, physiology, and pathophysiology. Topics will include patient care, integration of data, and imaging protocol. Restricted to major or consent of school. Introduce small parts ultrasound and their protocol based on region specific and their special requirement and patterns while paying attention on patient preparation and care.

**Minimum Academic Standards**

A lecture hall with a minimum capacity for 50 students having a projector and availability of the wireless network. A demonstration laboratory with at least 3 ultrasound equipment necessary for students hand on/demonstration is required. Images, videos, and projector demonstrations are also essentials.

**Bayero University, Kano**

**Faculty of Allied Health Science**

**Department of Medical Radiography**

**B.RAD. Radiography**

**BUK-RAD 503: Computed Tomography II (protocols and Clinical Applications) (3 Units, Core, LH=45, PH= 0)**

### Senate approved relevance

Despite CT being a newer imaging modality, they are gradually becoming popular in the African community with massive need by our patients due its tremendous capabilities and fast image acquisitions. These capabilities complex with their attendant needs for Radiography graduates to be equipped with the needed skills necessary to fill in the demand. This is in line with the university's vision and mission of providing leadership in research and education in Africa while also addressing African development challenges through cutting- edge research, knowledge transfer, and the training of high-quality graduates.

**Overview**

The use of multi-detector Computerize Tomography systems permits the tracking of contrast media in blood vessels and use to study blood and blood vessels. The aim of this course is to provide an in-depth knowledge of CT and its applications.

The course will also offer examples of different protocols that are in use in the clinics for the computed tomography investigations. This has become very necessary in view of the increasing demand for high quality investigations of which CT is one.

**Objectives of the Course**

The objectives of the course are to:

1. Review sectional anatomy of structures seen in CT in the axial, coronal and sagittal planes.
2. Evaluate technical factors affecting patient dose while applying radiation dose reduction techniques for pediatric and adult patients
3. Calculate radiation doses in CT using CT Dose Index and Dose Length Product
4. Discuss image display parameters, image processing techniques and analysis CT images for image quality assessment
5. Summarize image informatics, such as DICOM, PACS, networking and security protocols
6. Explain CT image artifacts, their causes and remedy methods
7. Explain the procedure for protocol development, patient care in CT, indication and contraindication for most CT exams and justification for adjustments where necessary.
8. Explain protocols for imaging the CNS, musculoskeletal, neck/thorax, and abdominopelvic both for normal and pathologic conditions
9. Explain protocols for imaging the CNS, musculoskeletal, neck/thorax, and abdominopelvic both for normal and pathologic conditions
10. Explain protocols for imaging the head, neck, thorax, mediastinum, abdomen, and pelvis; positioning techniques, patient preparation, monitoring and care,
11. Discuss CT image 3D reconstruction CTAs; cardiac, including gating, biopsies, drains, postmyelography, radiation therapy planning, and 4D imaging; CT arthrography, PET/CT, SPECT/CT, virtual colonoscopy

**Learning Outcomes**

On completion of the course, the students should be able to:

1. Revised the sectional anatomy of structures seen in CT in the axial, coronal and sagittal planes.
2. Elaborate the technical factors affecting patient dose while applying radiation dose reduction techniques for pediatric and adult patients.
3. Conduct calculations on radiation doses in CT using CT Dose Index and Dose Length Product.
4. Explain the image display parameters, image processing techniques and analysis CT images for image quality assessment.
5. Analyze image informatics, such as DICOM, PACS, networking and security protocols
6. Discuss CT image artifacts, their causes and remedy methods.
7. Develop the procedure for protocol development, patient care in CT, indication and contraindication for most CT exams and justification for adjustments where necessary.
8. Discuss protocols for imaging the CNS, musculoskeletal, neck/thorax, and abdominopelvic both for normal and pathologic conditions.
9. Discuss protocols for imaging the CNS, musculoskeletal, neck/thorax, and abdominopelvic both for normal and pathologic conditions.
10. Explain protocols for imaging the head, neck, thorax, mediastinum, abdomen, and pelvis; positioning techniques, patient preparation, monitoring and care.
11. Explain CT image 3D reconstruction CTAs; cardiac, including gating, biopsies, drains, postmyelography, radiation therapy planning, and 4D imaging; CT arthrography, PET/CT, SPECT/CT, virtual colonoscopy.

**Course Content**

Sectional anatomy identifiable on computed tomography and magnetic resonance imaging, including transverse, coronal, and sagittal planes. Physical principles and instrumentation; historical development and evolution of CT; characteristics of radiation, beam attenuation, linear attenuation coefficients, tissue characteristics, Hounsfield numbers, data acquisition, image manipulation techniques, tube configuration, collimation design and function, detectors, image quality factors, functions of CT computer and array processor; image processing and display examined from data acquisition through postprocessing and archiving; radiation protection practices and QC. Common pathological conditions found in CT and MRI images; protocol appearance variations; units of CNS, musculoskeletal, neck/thorax, and abdominopelvic pathology. Computed tomography procedures of the head, neck, thorax, mediastinum, abdomen, and pelvis; positioning techniques, patient preparation, monitoring and care, indications and contraindications for procedures; contrast media usage; basic protocol information with adjustments to tailor procedures for patient's indications; brief units on patient care relevant to CT; CT parameters and equipment. Imaging information in musculoskeletal exams, 3D reconstruction, CTAs; cardiac, including gating, biopsies, drains, post-myelography, radiation therapy planning, and 4D imaging; CT arthrography, PET/CT, SPECT/CT, virtual colonoscopy; procedure indications and contraindications, patient and room preparation, positioning techniques, contrast media usage, and scan parameters; basic protocol information and how to tailor procedures to a patient's indications

**Minimum Academic Standards**

A lecture hall with a minimum capacity for 50 students having a projector and availability of the wireless network. TV monitor for video demonstration on CT operations, protocol development, image viewer and models are required.

**Bayero University, Kano**

**Faculty of Allied Health Science**

**Department of Medical Radiography**

**B.RAD. Radiography**

**BUK-RAD 505: Quality Assurance in Radiography (2 Units, Core, LH=30, PH= 0)**

### Senate approved relevance

Radiography involves the use of technology in its operations. Machines are designed and specialized to meet specifications. Ideally, these standards are expected to be maintained throughout the life span of the equipment with allowable limits of deviations due to wear and tear. Quality assurance in Radiography and clinical application of radiation is necessary to ensure quality, safety and the reduction of unwarranted exposure of patients and personnel to ionizing radiation. The reduction of unproductive exposure of patients is central to optimization of radiation protection. This is in line with the university's vision and mission of providing leadership in research and education in Africa while also addressing African development challenges through cutting- edge research, knowledge transfer, and the training of high-quality graduates.

**Overview**

This course is designed to familiarize students with the basic concepts of quality assurance as applied to diagnostic imaging equipment and workflow. As the field of radiography evolves in the digital age, it is essential for radiographers to understand the functioning and limitations of their equipment. Additionally, radiographers can play a vital role in improving the overall throughput and patient experience at an imaging facility. The course explores the concepts and methods used to ensure the proper performance of an x-ray unit, and the test our equipment for compliance with established parameters. It will introduce the processes by which institutions assess their systems, and apply these principles to topics of our own.

The course was designed to give the students the skills to perform basic and routine quality control (QC) measures necessary for the maintenance of equipment and quality radiographic outcome. The course is designed to allow learners to develop their professional knowledge, understanding and competence in Radiological Quality Assurance in line with their identified personal development requirements. 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 of Quality assurance actions includes both "quality control" techniques and "quality administration" procedures will be taught in this course.

**Objectives of the Course**

The objectives of the course are to:

1. Explain quality assurance and quality control
2. Explain the aim of QA and the importance of a quality assurance program
3. Describe the elements of quality control
4. Describe the steps for daily, and schedule quality control measures (routine procedures used to evaluate the performance of an individual x-ray unit)
5. Inspect the external aspects of a unit, and identify potential hazards or malfunctions
6. Explain the parameters of compliance for various aspects of the x-ray unit
7. Illustrate laboratory reports that present the methods used to gather data, process the data, and compare the results to established regulations.
8. Describe the quality improvement process of an imaging facility, and how to be an effective participant
9. Explain the development of QC record templates and charts
10. Discuss the need to participate in the day to day maintenance of a radiology department, with an awareness of hazards or malfunctions with a unit, and the ability to identify the causes of the malfunction
11. Explain the establishment of a QC committee and its functions

**Learning Outcomes**

On completion of the course, the students should be able to:

1. Explain quality assurance and quality control
2. Explain the aim of QA and the importance of a quality assurance program
3. Describe the elements of quality control
4. Describe the steps for daily, and schedule quality control measures (routine procedures used to evaluate the performance of an individual x-ray unit)
5. Inspect the external aspects of a unit, and identify potential hazards or malfunctions
6. Explain the parameters of compliance for various aspects of the x-ray unit
7. Illustrate laboratory reports that present the methods used to gather data, process the data, and compare the results to established regulations.
8. Describe the quality improvement process of an imaging facility, and how to be an effective participant.
9. Explain the development of QC record templates and charts.
10. Discuss the need to participate in the day to day maintenance of a radiology department, with an awareness of hazards or malfunctions with a unit, and the ability to identify the causes of the malfunction.
11. Explain the establishment of a QC committee and its functions

**Course Content**

Introduction and definition of QA and QC. Aim of QC, responsibility for QC. QC committee and personnel, QC procedure and testing, program establishment, QC instruments, instrument calibration, acceptance test, post maintenance and periodic QC, QA scheme, Daily checks, power supply and cables, x-ray accessories, QC records format, x-ray generator, tube output, kVp accuracy and reproducibility, mA accuracy, timer accuracy, HVL, light beam, diaphragm, x-ray field delineation, darkroom QC, film processor, Film reject analysis, entrance skin dose, personnel training, interpretation of results, identification of faults, report escalation. Equipment Inspection/Writing lab reports. Linearity, reproducibility, half-value layer. AEC, light field-radiation field alignment, resolution. Quality Control for digital detectors and storage on PACS Departmental Quality Assurance process.

**Minimum Academic Standards**

A lecture hall with a minimum capacity for 50 students having a projector and availability of the wireless network is required. QA and QC kits are required for demonstration of basic procedures

**Bayero University, Kano**

**Faculty of Allied Health Science**

**Department of Medical Radiography**

**B.RAD. Radiography**

**BUK-RAD 506: Forensic Radiography (2 Units, Core, LH=30, PH= 0)**

### Senate approved relevance

Criminal activities are on the increase and in sophistication all over the world and there is need to support inquest into violent and organized criminal cases involving materials easily detectable with the use of any of the radiographic imaging modalities. Providing a course which will help to objectively arrive at a conclusive evidence injury causes, identification, age, number, date and form will be in line with the university's vision and mission of providing leadership in research and education in Africa while also addressing African development challenges through cutting- edge research, knowledge transfer, and the training of high-quality graduates

**Overview**

The course was designed to teach adequate and efficient skills of the application of x-ray and other imaging modalities techniques to aid in forensic investigations in human and non-human objects and their critical analysis. A forensic protocol that adheres to relevant guidance and legislation and gain skills in producing images that are acceptable in court, by learning about the requirements for high-quality evidence.

The course will also teach about the imaging of both children and adults for suspected physical abuse, the use of post-mortem cross-sectional imaging as an alternative to invasive autopsy, using imaging to locate forensic evidence such as drug smuggling and ballistic material, identification of the deceased, and age assessments for human trafficking or illegal immigration.

### Objectives

The objectives of the course are to:

1. Explain forensic investigations the fundamental principles used in forensic radiography
2. Discuss the current regulations regarding the use of ionizing radiation for forensic purposes
3. Discuss the use of appropriate modality for any investigation with their advantages and limitations.
4. Develop imaging techniques/protcols appropriate for the procedure and results analyses
5. Discuss medico-legal autopsy and techniques of objective conclusions.

### Learning Outcomes

On completion of the course, the students should be able to:

1. Discuss the fundamental principles of imaging techniques used in forensic Radiography
2. Identify current ionizing radiation regulations and apply appropriate radiation protection measures and their applications in forensic radiography.
3. Identify and analyse the imaging modalities and their use in recovery analysis with their advantages and limitation.
4. Practically apply appropriate imaging techniques for defined situations and interpret the results.
5. Explain medico-legal autopsy and techniques necessary for an objective conclusion/result.

### Course Content

Review of the physics of X-ray production. Radiographic equipment. analogue and digital image recording media. Radiation protection and legislation. Basic forensic medicine and science. The definition of medical jurisprudence and medical ethics. The radiography Act. Medical practice act, medicolegal autopsy. Medical imaging techniques and positioning/projections for use in ante and post mortem examinations. The virtual post-mortem. A forensic protocol that adheres to relevant guidance and legislation and gain skills in producing images that are acceptable in court. Radiographic techniques applied to art work, injury, fire arms, injuries, explosive injuries. Characterization of trauma and disease state. Industrial radiographic techniques for engineering components including weapons, missiles and improvised explosive devices. Complimentary imaging modalities – computed tomography. Magnetic resonance imaging. Ultrasound. Identification and interpretations of results. Imaging of both children and adults for suspected physical abuse, the use of post-mortem cross-sectional imaging as an alternative to invasive autopsy, using imaging to locate forensic evidence such as drug smuggling and ballistic material. Identification of the deceased. Age assessments for human trafficking or illegal immigration.

**Minimum Academic**

A lecture hall with a minimum capacity for 50 students having a projector and availability of the wireless network. Images for demonstrations are essential.

**Bayero University, Kano**

**Faculty of Allied Health Science**

**Department of Medical Radiography**

**B.RAD. Radiography**

**BUK-RAD 507: Industrial Radiography (2 Units, Core, LH=30, PH= 0)**

### Senate approved relevance

Industrial Radiography or Radiographic Testing (RT) uses ionizing electromagnetic radiation to view objects in a way that can't be seen otherwise. It is a method of inspecting materials for hidden flaws by using the capability of short wavelength electromagnetic radiation, x-rays and gamma radiation, to penetrate various materials. In many locations in the United States, industrial radiographers are required by governing authorities, i.e., the State in which the testing occurs, to adhere to certain mandatory safety standards that specify such things as the use of certain types of safety equipment and working in pairs. The safety equipment usually includes at least one of four basic items: a radiation survey meter (such as a Geiger/Mueller counter), an alarming dosimeter or rate meter, a gas-charged dosimeter, and a film badge or thermo-luminescent dosimeter (TLD). It is imperative for Radiography graduates to have background knowledge of the current trends and development in Non-destructive testing (NDT). Many Radiography graduates are not conversant with NDT. As Africa strides to develop, it will be difficult to bridge the gap between theory and leaning in a world of technological advancement. This is in line with the mission and vision of Bayero University Kano where it strives to provide leadership in research and education in Africa while making specific emphasis on addressing African development challenges through cutting- edge research, knowledge transfer, and the training of high-quality graduates, this course is a designed to begin to bridge this gap in the near future.

### Overview

This course is designed to introduce radiography students to industrial radiography, non-destructive testing and its applications in the industries in Nigeria. The course is designed to Introduce students to basic industrial radiography and its application in non-destructive testing.

The course will also describe Theoretical basis for industrial Radiography and the practical field application of NDT. Explain the Modalities in nondestructive testing (NDT). Discuss Potential hazards and Radiation safety in industrial radiography. Have hands on training on techniques involved in NDT. This course provides formal classroom training in the art and science of radiographic film interpretation. Some previous knowledge of or experience in Industrial Radiography is required.

### Objectives of the Course

The objectives of the course are to:

1. Discuss Introduction to basic industrial radiography
2. Describe Theoretical basis for industrial Radiography. Practical field application of NDT
3. Explain the Modalities in non-destructive testing (NDT)
4. Discuss Potential hazards and Radiation safety in industrial radiography
5. Make students have hands on training on techniques involved in NDT.

### Learning Outcomes

On completion of the course, the students should be able to:

1. Discuss Introduction to basic industrial radiography
2. Describe Theoretical basis for industrial Radiography. Practical field application of NDT
3. Explain the Modalities in non-destructive testing (NDT)
4. Discuss Potential hazards and Radiation safety in industrial radiography
5. Have hands on training on techniques involved in NDT.

### Course Content

Introduction to basic industrial radiography. Theoretical basis for industrial Radiography. Practical field application of NDT in the industries. Various applications. Techniques. Modalities in industrial radiography. Modalities in non- destructive testing (NDT). Potential hazards. Radiation safety. Occupational safety. Laboratory experiences. Practical application. Hands on applications and techniques involved in NDT. Radiation detectors including Dosimeter, survey meter, film badge, TLD. Exposure Techniques (Single Wall, double wall, panoramic, use of multiple films), Shooting a radiograph: film type selection, exposure time, radiographic technique setup, setup and geometrical sharpness, establishing 2mR boundary, IQI selection and placement, location markers. The techniques and proper procedures of radiographic film interpretation. Guided instruction in the evaluation of actual weld radiographs of types of discontinuities, non-relevant artifacts, and different set ups. Welding Inspectors, QA/QC Auditors, Engineers, Radiographers and others wishing to improve their understanding and skill in this important segment of radiography.

### Minimum Academic Standards

Availability of the wireless network is required. TV screens, images, fosters and accessories are required for essential teaching.