KAZI NAZRUL UNIVERSITY
School of Health Science and Technology Department
of Allied Health Science and Technology
UG Learning Outcome Based Curriculum (LOCF) for B.Sc in Medical Radiology and Imaging Technology

PROGRAM OUTLINE

Semester I

Course Code	Course Name	L - T - P	Credits	Total Marks
BMRITC101	Human Anatomy	4-0-0	4	100
BMRITC 102	Human Anatomy Practical	0-0-4	2	100
BMRITC 103	Human Physiology	4-0-0	4	100
BMRITC 104	Human Physiology Practical	0-0-4	2	100
BMRITC 105	National Healthcare Delivery System	4-0-0	4	100
AECC101	Computer Application	4-0-0	4	100
AECC102	Computer Application Practical	0-0-4	2	100
AECC103	English Communication	3-0-0	3	100
TOTAL			**25**	**800**

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Semester- I

Course Name: Human Anatomy
Course Code: BMRITC101

Course Type: Core (Theoretical)	Course Details: CC-1			L-T-P: 4 - 0 - 0	
Credit: 4	Full Marks: 100	CA Marks		ESE Marks	
		Practical	Theoretical	Practical	Theoretical
		….	30	….	70

Course Learning Outcomes:
1. Comprehend the normal disposition, inter-relationships, gross, functional and applied anatomy of various structures in the human body.
2. Identify the microscopic structures of various tissues, and organs in the human body and correlate the structure with the functions.
3. Comprehend the basic structure and connections between the various parts of the central nervous system so as to analyze the integrative and regulative functions on the organs and systems.

Module	Topics	No. of Lectures
Module 1	**Introduction to Human Anatomy:** Anatomy: Definition and its relevance Planes of the body, relationship of structures, organ system	4
Module 2	**Skeleton System:** Structure, Functions	4
Module 3	**Tissues of the Body:** Epithelium,connectivetissue,boneandcartilage,Embryology,histology, different types of each of them, types of cells, cellular differentiation and arrangements in different tissues	6
Module 4	**Muscles:** Different types of muscles, their functional differentiation, their relationship with different structures, their neural supply	4
Module 5	**Blood vessels:** Differentiation between arteries and veins, embryology, histology of both arteries and veins, Functional differences between the two, anatomical differences at different locations	6
Module 6	**Skin and appendages:** Embryology, anatomical differences in different areas, functional and protective variations, innervations, relationship with muscles and nerves	4
Module 7	**Lymphatic system:** Embryology, functions, relationship with blood vessels and organs	4

Module 8	**Glands:** Embryology, different types of glands (exocrine and endocrine), functional differences, neural control of glands	4
Module 9	**Nervous system:** Parts of Nervous system, cell types of nervous system, Blood-brain barrier, Reflex arc, Peripheral Nerves, Spinal nerves, Nerve fibers, Autonomic Nervous system	6
Module 10	**Brain and Cranial nerves:** Major parts of Brain, Protective coverings of the Brain, Cerebrospinal Fluid, Brain stem, Cerebellum, Diencephalon, Cerebrum, Cranial nerves	6
	Total Number of Hours= 48	

Text Books:-

1. MARIANO S.H. DIFIORE: Atlas of Human Histology, 5th Ed. 1981, Lea and Feliger.
2. B.D. CHAURASIA: Handbook of General Anatomy, 2nd Ed., CBS Publishers and Distributors, New Delhi - 110 032.

Reference Books:-

1. PETER L. WILLIAMS AND ROGER WARWICK: - Gray's Anatomy - Descriptive and Applied, 36th Ed., 1980, Churchill Livingstone.
2. R. KANAGASUNTHARAM, P. SIVANANDA-SINGHAM & A. KRISHNAMURTI: Anatomy-Regional, Functional, & Clinical, P.G. Publisher, Singapore1987.

Course Name: Human Anatomy Practical
Course Code: BMRITC102

Course Type: Core (Practical)	Course Details: CC-2			L-T-P: 0 - 0 - 4	
Credit: 2	Full Marks: 100	CA Marks		ESE Marks	
		Practical	Theoretical	Practical	Theoretical
		60	----	40	----

Course Learning Outcomes:

1. Utilize compound microscope to perform microscopic study of epithelial, connective, muscular and nervous tissue.
2. Identify axial and appendicular bones of human body.
3. Practice use of Hemocytometer for enumeration of white blood cell (WBC) and red blood corpuscles (RBC).
4. Estimate bleeding time, clotting time, hemoglobin content and erythrocyte sedimentation rate (ESR).
5. Identify blood group, determine heart rate, pulse rate and record blood pressure.

Module	Topics	No. of Practical D + P*
Module 1	Study of compound microscope	2 + 2
Module 2	Identification of muscular and nervous system	4 + 4
Module 3	Identification of axial bones Identification of appendicular bones	4 + 4
Module 4	Introduction to hemocytometry	2 + 2
Module 5	Enumeration of white blood cell (WBC) count Enumeration of total red blood corpuscles (RBC) count	4 + 4
Module 6	Determination of bleeding time Determination of clotting time	2 + 2
Module 7	Determination of blood group. Determination of erythrocyte sedimentation rate (ESR).	4 + 4
Module 8	Determination of heart rate and pulse rate Recording of blood pressure	2 + 2
	Total Number of Hours= 48	

*** D - Demonstration & P - Practice**

Text Books:-

1. MARIANO S.H. DIFIORE: Atlas of Human Histology, 5th Ed. 1981, Lea and Feliger.
2. B.D. CHAURASIA: Handbook of General Anatomy, 2nd Ed., CBS Publishers and Distributors, New Delhi - 110 032.

Reference Books:-

1. PETER L. WILLIAMS AND ROGER WARWICK: - Gray's Anatomy - Descriptive and Applied, 36th Ed., 1980, Churchill Livingstone.
2. R. KANAGASUNTHARAM, P. SIVANANDA-SINGHAM & A. KRISHNAMURTI: Anatomy-Regional, Functional, & Clinical, P.G. Publisher, Singapore1987.

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Course Name: Human Physiology
Course Code: BMRITC103

Course Type: Core (Theoretical)	Course Details: CC-3			L-T-P: 4 - 0 - 0	
Credit: 4	Full Marks: 100	CA Marks		ESE Marks	
		Practical	Theoretical	Practical	Theoretical
		….	30	….	70

Course Learning Outcomes:

1. Explain the normal functioning of various organ systems of the body and their interactions.
2. Elucidate the physiological aspects of normal growth and development.
3. Describe the physiological response and adaptations to environmental stresses.
4. Know the physiological principles underlying pathogenesis of disease.

Module	Topics	No. of Lectures
Module 1	**CELL STRUCTURE & ORGANIZATION** Tissue organization Epithelium Connective tissue –Collagen fibers –Elastic fibers – Areolar fibers Cartilage –Bone Contractile tissue –striated –skeletal –cardiac –non striated –plain – myoepithelial General principles of cell physiology Physiology of skeletal muscle	6
Module 2	**BLOOD:** Composition Volume measurement & variations Plasma proteins –classification & functions. Red blood cells –development, morphology & measurements –functions & dysfunctions. White blood cells –development –classification, morphology –functions & dysfunctions. Platelets –morphology –development, functions & dysfunctions Clotting –factors –mechanism –anti- coagulants dysfunctions Blood grouping –classification –importance in transfusion, Rh factor & incompatibility Suspension stability Osmotic stability Reticulo endothelial system o Spleen, lymphatic tissue, Thymus, bone marrow, immune system, cellular, Humoral, Autoimmune	6

Module 3	**DIGESTION:** General arrangement Salivary digestion –functions & regulations Gastric digestion –functions & regulations Pancreatic digestion –functions & regulations Intestinal digestion –functions & regulations Liver & bile Functions of large intestine Neurohumoral regulations of alimentary functions, summary	4
Module 4	**EXCRETION:** Body fluids –distribution, measurement & exchange, Kidney –structure of nephron –mechanism of urine formation –composition of the urine and abnormal constituents –urinary bladder & micturition	2
Module 5	**ENDOCRINES**: Hormone mechanism –negative feed backs –tropic action –permissive action – cellular action, hypothalamic regulation Thyroid - hormones, actions, regulations Adrenal cortex - hormones, actions, regulations Adrenal medulla –hormones, actions, regulations Parathyroid - hormones, actions, regulations Islets of pancreas –hormones, actions, regulations Miscellaneous _ hormones, actions,regulations Common clinical disorders	4
Module 6	**REPRODUCTION:** Male reproductive system –control & regulation Female reproductive system –uterus –ovaries –menstrual cycle –regulation –pregnancy & delivery –breast –family planning	4
Module 7	**RESPIRATION:** Mechanics of respiration –pulmonary function tests –transport of respiratory gases-neural and chemical regulation of respiration –hypoxia, cyanosis, dyspnoea– asphyxia.	4
Module 8	**CIRCULATION:** Generalprinciples Heart: myocardium –innervation –transmission of cardiac impulse- Events during cardiac cycle –cardiac output. Peripheral circulation: peripheral resistances –arterial blood pressure –measurements –factors regulation variations –capillary circulation –venous circulation. Special circulation: coronary cerebral –miscellaneous	4
Module 9	**ENVIRONMENTAL PHYSIOLOGY** Body temperature regulation (including skin Physiology). Exposure to low and high atmospheric pressure	4
Module 10	**NERVOUS SYSTEM:** Neuron –Conduction of impulse –synapse –receptor. Sensory organization –pathways and perception Reflexes –cerebral cortex –functions. Thalamus –Basal ganglia	6

	Cerebellum. Hypothalamus. Autonomic nervous system –motor control of movements, posture and equilibrium – conditioned reflex, eye hand co-ordination	
Module 11	**SPECIAL SENSES** –(Elementary) Olfaction –Taste –Hearing	4
	Total Number of Hours	**48**

Text Books:-

1. L Prakasam reddy, Fundamentals of Medical Physiology, 4th Edition, Paras medical Publisher, Hyderabad,2008
2. Sujit K. Chaudhuri, Concise Medical Physiology, 6th edition, New Central Book Agency, Kolkata, 2008

Reference Books:-

1. A C Guyton: Text book of Medical Physiology, 8th edition, saunders company, Japan

Course Name: Human Physiology Practical
Course Code: BMRITC104

Course Type: Core (Practical)	Course Details: CC-4			L-T-P: 0 - 0 - 4	
Credit: 2	Full Marks: 100	CA Marks		ESE Marks	
		Practical	Theoretical	Practical	Theoretical
		60	----	40	----

Course Learning Outcomes:

1. Handle microscopes on their own.
2. Perform different blood tests, e.g., blood counts (RBC, WBC, platelets, Hb and differential count), blood grouping, analysis of bleeding time and clotting time.
3. Perform examination on urine and detect presence of abnormal entities.
4. Demonstrate various parts of human Endocrine and Reproductive system.
5. Perform clinical examination of respiratory system like Spirometry, Breath holding test etc.
6. Practise routine examination of cardiovascular and circulatory system, including blood pressure and pulse rate measurement.
7. Demonstrate various parts of Central Nervous System.

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Module	Topics	No. of Practical D + P
Module 1	ood test: Microscope, Haemocytometer, Blood, RBC count, Hb, WBC count, Differential Count, Haematocrit demonstration, ESR, Blood group & Rh. type, Bleeding time and clottingtime	4 + 4
Module 2	gestion: Test salivarydigestions	4 + 4
Module 3	cretion: Examination of Urine,Specific gravity, Albumin, Sugar, Microscopic examination for cells andcysts	4 + 4
Module 4	ndocrinology and Reproduction: Dry experiments in the form of cases showing different endocrinedisorders.	4 + 4
Module 5	spiratory System: Clinical examination of respiratory system, Spirometry, Breath holding test	4 + 4
Module 6	rdio Vascular System: Clinical examination of circulatory system, Measurement of blood pressure and pulse rate, Effect of exercise on blood pressure and pulserate	2 + 2
Module 7	ntral Nervous System: Sensory system, Motor system, Cranial system, Superficial and deepreflexes	2 + 2
	Total Number of Hours= 48	

Text Books:-

3. L Prakasam reddy, Fundamentals of Medical Physiology, 4th Edition, Paras medical Publisher, Hyderabad,2008
4. Sujit K. Chaudhuri, Concise Medical Physiology, 6th edition, New Central Book Agency, Kolkata, 2008

Reference Books:-

2. A C Guyton: Text book of Medical Physiology, 8th edition, saunders company, Japan

Course Name: National Healthcare Delivery System

Course Code: BMRITC105

Course Type: **Core (Theoretical)**	Course Details: **CC-5**		L-T-P: **4- 0 - 0**	
Credit: **4**	Full Marks: **100**	CA Marks		ESE Marks	
		Practical	Theoretical	Practical	Theoretical
		….	**30**	….	**70**

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Course Outcomes:

1. Discuss the preliminary idea of health care and its delivery system related to various socio-economic aspect and community-based approach.
2. Describe the different types of health policies, organizations and issues in health care delivery system in India.
3. Explain the national health programme and elaborate its objectives, targeted area, achievements and constraints.
4. Interpret the various AYUSH system of medicine and its integration/interrelation among Ayurveda, Yoga and Naturopathy, Unani, Siddha and Homeopathy.
5. Illustrate the health scenario of public health in India based on two aspect demography and epidemiology.

Module	Topics	No of lectures
Module 1	**Concepts of Health** Definition of health; evolution in concepts of public health; public health events sanitary awakening, germ theory of disease, rise of public health in various countries, changing concepts of health- biomedical concept, ecological concept, psycho-social concept and holistic concept.	4
Module 2	**Dimensions of Health** Physical dimension, mental dimension, Social dimension etc; Common health problems in India - Communicable diseases, Non communicable diseases, MCH problems, Nutritional problems, Environmental sanitation, Glance over National Health profile.	4
Module 3	**Evolution of health care delivery systems** History of health care delivery services; Genesis of primary health care; National health policy; MDGs.	6
Module 4	**Levels of health care** Primary health care, secondary health care, tertiary health care. Primary health care-principles of primary health care, elements of primary health care.	4
Module 5	**Primary health care: Delivery of services** troduction; Structure of health care delivery system; Delivery of primary health care services at village level; Village health guide, ASHA, ICDS: Subcentre: Primary health centre.	4
Module 6	**Secondary and tertiary health care: Delivery of services** Community Health centre; First referral unit; District hospital.	6
Module 7	**Primary health care - Current status in India** Status of health care infrastructure; Health team concept; Health insurance; Social security and social assistance in health; AYUSH.	6

Module 8	**National Health Programmes** Introduction; National Vector Borne Disease Control Programme; National Leprosy Eradication Programme; Revised National Tuberculosis Control Programme; National AIDS Control Programme; Universal Immunization Programme; National Rural Heath Mission.	4
Module 9	**National Health Programmes** Reproductive and Child Health Programme; Integrated Management of Neonatal and Childhood Illnesses; National Nutritional Anemia Prophylaxis Programme; National Programme for Control of Blindness; National Cancer Control Programme; National Mental Health Programme.	4
Module 10	**First aid** Basic terminologies; general guidelines; first aid in specific situations; Wound, bleeding, fracture, choking, burns, epistaxis, strains and sprain, animal bites (classification, causes and first aid), Cardio-pulmonary resuscitation.	6
	Total Number of Hours	**48**

Text Books

1. Park K. Park's Textbook of Preventive and Social Medicine. 23rd ed. Jabalpur:

BanarsidasBhanot Publishers, 2015.p.135-141

Reference Book:

1. Suryakantha. Textbook of Community Medicine with recent advances. 4th edition.

Course Name: Computer Application
Course Code: AECC101

Course Type: Core (Theoretical)	Course Details: AECC-1			L-T-P: 4 - 0 - 0	
Credit: 4	Full Marks: 100	CA Marks		ESE Marks	
		Practical	Theoretical	Practical	Theoretical
		….	30	….	70

Course Learning Outcomes:

1. Understand the fundamental hardware components that make up a computer's hardware and the role of each of these components
2. Understand the difference between an operating system and an application program, and what each is used for in a computer
3. Describe some examples of computers and state the effect that the use of computer technology has had on some common products
4. Be familiar with software applications
5. Understand file management
6. Accomplish creating basic documents, worksheets, presentations with their properties.
7. Experience working with email and recognize email netiquette.

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Module 1
Introduction and Definition of Computer: Computer Generation, Characteristics of Computer, Advantages and Limitations of a computer, Classification of computers, Functional components of a computer system (Input, CPU, Storage and Output Unit), Types of memory (Primary and Secondary) Memory Hierarchy. Hardware: a) Input Devices- Keyboard, Mouse, Scanner, Bar Code Reader b) Output Devices – Visual Display Unit (VDU), Printers, Plotters etc. Software: Introduction, types of software with examples, Introduction to languages, Compiler, Interpreter and Assembler. Number System: Decimal, Octal, Binary and Hexadecimal Conversions, BCD, ASCII and EBCDIC Codes. (Lecture 12)

Module 2
MS – DOS: Getting Started on DOS with Booting the System, Internal Commands: CHDIR(CD),CLS, COPY, DATE, DEL(ERASE), DIR, CHARACTER, EXIT,MKDIR(MD), REM, RENAME(REN), RMDIR(RD), TIME, TYPE, VER, VOL, External Commands: ATTRIB, CHKDSK, COMMAND, DOSKEY, EDIT, FORMAT,HELP, LABEL, MORE, REPLACE, RESTORE, SORT, TREE, UNDELETE, UNFORMAT,XCOPY.
Introduction of Internet: History of internet, Web Browsers, Searching and Surfing, Creating an E-Mail account, sending and receiving E-Mails. (Lecture 08)

Module 3
MS Word: Starting MS WORD, Creating and formatting a document, Changing fonts and point size, Table Creation and operations, Autocorrect, Auto text, spell Check, Word Art, Inserting objects, Page setup, Page Preview, Printing a document, Mail Merge.
(Lecture 08)

Module 4
MS Excel: Starting Excel, Work sheet, cell inserting Data into Rows/ Columns, Alignment, Text wrapping , Sorting data, Auto Sum, Use of functions, Cell Referencing form, Generating graphs, Worksheet data and charts with WORD, Creating Hyperlink to a WORD document, Page set up, Print Preview, Printing Worksheets.
MS Power Point: Starting MS–Power Point,, Creating a presentation using auto content Wizard,

Blank Presentation, creating, saving and printing a presentation, Adding a slide to presentation, Navigating through a presentation, slide sorter, slide show, editing slides, Using Clipart, Word art gallery, Adding Transition and Animation effects, setting timings for slide show, preparing note pages, preparing audience handouts, printing presentation documents. MS – Access: creating table and database.
(Lecture 08)

Module 5
MS-POWERPOINT: Starting MS–Power Point,, Creating a presentation using auto content Wizard, Blank Presentation, creating, saving and printing a presentation, Adding a slide to presentation, Navigating through a presentation, slide sorter, slide show, editing slides, Using Clipart, Word art gallery, Adding Transition and Animation effects, setting timings for slide show, preparing note pages, preparing audience handouts, printing presentation documents.
(Lecture 12)

Total lectures (12+8+8+8+12 = 48 hrs.)

Text Books:
1. Sinha P.K., Computer Fundamentals, BPB Publishing.
2. Bill Bruck., The Essentials Office 2000 Book, BPB Publishing.
3. Leon A. & Leon M., Introductions to Computers, Vikas Publications.

Reference Books:
1. Peter Norton_s, Introductions to Computers, Tata McGraw Hill.
2. Price Michael, Office in Easy Steps, TMH Publication.

Course Name: Computer Application Practical
Course Code: AECC102

Course Type: Core (Practical)	Course Details: AECC-2			L-T-P: 0 - 0 - 4	
Credit: 2	Full Marks: 100	CA Marks		ESE Marks	
		Practical	Theoretical	Practical	Theoretical
		60	----	40.	----

Computer fundamental and internet lab Practical (3×16 = 48 hrs.)

1. Using basic DOS commands.
2. Using external DOS commands
3. Creating a email account
4. Using web browser for searching and surfing.
5. Creating and formatting a document in MS office
6. Using autocorrect, auto text and spell check operation in MS office.
7. Create tables in MS Word.
8. Inserting different kinds of object in MS word.
9. Use main merger options in MS office.
10. Create an Excel work sheet with following options rows and columns alignment.
11. Using excel formulas.
12. Create a graph with available data in MS excel.
13. Create a PPT presentation using auto content wizard.
14. Use Clip art animation effects and word art galleries in presentations.
15. Using transition and setting timings for slide show.
16. Use MS access to create data base and tables.

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Course Name: English Communication
Course Code: AECC103

Course Type: Core (Theoretical)	Course Details: AECC-3			L-T-P: 3 - 0 - 0	
Credit: 3	Full Marks: 100	CA Marks		ESE Marks	
		Practical	Theoretical	Practical	Theoretical
		….	30	….	70

Course Learning Outcomes:

1. Students will realize the significance of English for their career progression
2. Benchmarking the students in the first semester to observe their progression in terms of LSRW
3. Students will be able to understand distinct sounds and improve pronunciation
4. Students will improve their English vocabulary of daily usage
5. Students will be able to form simple sentences to talk about themselves, friends and relatives.
6. Students will be able to imbibe the pre-requisites of personality development.

Module -1: Introduction to English language (7 Lectures)

a) Role and significance of English language in the present scenario
b) English Language: Its relevance for the Indian industry
c) Introduction to Listening, Speaking, Reading, Writing (LSRW) and benchmarking of the class

[Note: As part of classroom activity, a guest lecture from an industry representative/Director (CRC) and maintaining progress card for each student on LSRW for future reference]

Module -2: Phonetics& Functional Grammar (7Lectures)

a) Pronunciation and daily usage correction (speak with differences between p/b, s/sh, f/ph, t/d, v/w sounds)
b) Parts of speech, articles, tenses, verbs and modals
c) Practice of daily use words, numerals and tongue twisters
d) Vocabulary building, Construction of simple sentences: Basic sentence pattern, subject and Predicate

[Note: As part of classroom activity, language games, tongue & jaw exercises, simple passages from the newspapers for oral drills in the classroom and practice tests (written and oral)]

Module -3: English Communication- About Myself (7 Lectures)

a) Let's talk, making conversation, meeting and greeting
b) Introducing myself, my family and my friends
c) My opinions, my likes and dislikes
d) Life at college, hostel and workplace

[Note: As part of classroom activity, use the Work book for reference for classroom and home assignments, carry out practice tests (written and oral)]

Module -4: Basic Communication & Soft Skills (7 Lectures)

a) Reading comprehension
b) Building conversational skills
c) Verbal & Non-verbal communication
[Note: As part of classroom activity, review and recap the last semester and carry out (oral and written) practice test to update the progress card of each student, refer to the Workbook]

Module -5: Vocabulary: Building Blocks (7 Lectures)
a) Word Formation: Prefix, suffix, conversion and compounding
b) Homophones and one-word substitution
c) Words often confused and misused
d) Idiomatic phrase, Antonyms and Synonyms
[Note: As part of classroom activity, organise and learning language games, initiate the learning of 5 new words per class]

Module-6: English Communication: World around Me (6 Lectures)
a) Market place, Bus stop, Bank, Post Office
b) Village, Town and City
c) Eating out: Stall, Dhaba and Restaurant
[Note: As part of classroom activity, refer Work book for classroom and home assignments, carry out practice tests (written and oral)]

Module -7: Personality Development (7 Lectures)
a) First impression: Dressing sense, good manners, speaking well and respectably
b) Positive Attitude: Being happy and alert, a good listener and a good friend
c) Consultation among peers: Soliciting advice and giving advice
d) Goal setting, confidence building& handling rejection
[Note: As part of classroom activity, refer Work book for classroom and home assignments, carry out practice tests (written and oral)]

Total Lectures (7+7+7+7+7+6+7 = 48 hrs)

Reference Books:

ILFS Bi-lingual Course in Basic English, ILFS Skill Development Corporation English Grammar Composition & Usage by J.C. Nesfield, Macmillan Publishers The Business letters by Madan Sood, Goodwill Publishing House, New Delhi Communication Skills by Sanjay Kumar &PushpLata, Oxford University Press

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PROGRAM OUTLINE

Semester II

Paper Code	Paper Name	L - T - P	Credits	Total Marks
BMRITC201	Applied Human Anatomy and Physiology	4-0-0	4	100
BMRITC202	Fundamental Physics and Radiological Physics	4-0-0	4	100
BMRITC203	Conventional Radiography and Equipment	4-0-0	4	100
BMRITC204	Radiographic and Image Processing Techniques	4-0-0	4	100
BMRITC205	Radiographic and Image Processing Techniques Practical	0-0-4	2	100
See pool	Choose from the pool of generic elective courses offered in the second semester of allied health science disciplines other than the discipline in which the degree program is taken	See pool	4	100
AEE201	Environmental Studies	4-0-0	4	100
TOTAL			**26**	700

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Detailed Syllabus

Semester - II

Course Name: Applied Human Anatomy and Physiology
Course Code: BMRITC201

Course Type: Core (Theoretical)	Course Details: CC-6			L-T-P: 4 - 0 - 0	
Credit: 4	Full Marks: 100	CA Marks		ESE Marks	
		Practical	Theoretical	Practical	Theoretical
		….	30	….	70

Course Objective:

1. Anatomy is a key component of all education programmes for MRITs and should have a strong focus on organ position, orientation and relationships. The topics provide the student with an understanding of the structure and relationships of the systems and organs of the body which is essential in patient preparation and positioning. The radiographic anatomy component will enable MRIT's to evaluate images prior to reporting by the radiologist.
2. Similarly Physiology provides the students with knowledge of the function of systems and organs and their relationships and underpins the understanding of how various imaging modalities are to be selected depending upon the clinical history.

Module	Topics	Number of lecture
Module 1	Introduction to the body as a whole	5
Module 2	The cells, tissues of the body The cell: Structure, multiplication.	5
Module 3	Tissue: Types, structure, characteristics, functions Connective: Areolar, adipose, fibrous, elastic, Cartilage, blood and bone	5
Module 4	Muscle: Striated (Voluntary), Smooth (Involuntary, Cardiac)	5
Module 5	Nervous tissue Fibrous tissue Cell regeneration Membranes: Mucous, Serous, Synovial	10

Module 6	Osteology (including whole Skelton, bones and joints) Development of bone (ostogenesis) : Cells involved Types and functions of bone, Types of joints and various movements. AXIAL Skelton: Skull : Cranium, face, air sinuses, Vertebral column: regions, movements and characteristics, Sternum, Ribs Appendicular Skelton: Bones involving -Shoulder girdle and Upper limb, Pelvic girdle and lower limb, healing of bones: cellular activity, Factors that delay healing, Diseases of bones and joints.	9
Module 7	The Respiratory System: Organs: Position and structure, Nose and nasal cavities, Functions: respiratory, Olfactory, Pharynx, and Larynx: Functions - respiratory, vocal, Trachea, Bronchi, lungs: lobes, lobules, pleura, and respiratory functions: External and internal respiration, common terms relating to disease and conditions of the system.	9
	Total Numberof Lecture	**48**

Text Books:-

3. MARIANO S.H. DIFIORE: Atlas of Human Histology, 5th Ed. 1981, Lea Bandelier.
4. B.D. CHAURASIA: Handbook of General Anatomy, 2nd Ed., CBS Publishers and Distributors, New Delhi - 110 032.

Reference Books:-

3. PETER L. WILLIAMS AND ROGER WARWICK: - Gray's Anatomy - Descriptive and Applied, 36th Ed., 1980, Churchill Livingstone.
4. R. KANAGASUNTHARAM, P. SIVANANDA-SINGHAM & A. KRISHNAMURTI: Anatomy-Regional, Functional, & Clinical, P.G. Publisher, Singapore1987.

Course Name: Fundamental Physics and Radiological Physics
Course Code: BMRITC202

Course Type: Core (Theoretical)	Course Details: CC-7			L-T-P: 4 - 0 - 0	
Credit: 4	Full Marks: 100	CA Marks		ESE Marks	
		Practical	Theoretical	Practical	Theoretical
		….	30	….	70

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Module	Topics	Number of Lecture
Module 1	**Basic concepts:** Units and measurements-Force, work, power and energy-Temperature and heat-SI units of above parameters. Atomic structure-atom model-Nucleus-electronic configuration-periodic table-Isotopes-Ionization-excitation-Binding energy-electron volt Electromagnetic radiation-Quantum nature of radiation-mass energy equivalence Fluorescence-electromagnetic spectrum.	8
Module 2	**Electricity and magnetism:** Electric charges, Coulomb's law-Unit of charge-Electric potential, unit of potential-Electric induction, capacitance and Capacitors, series and parallel connection-electric current, unit, resistance, ohm's law, electric power, Joule's law. Varying currents-Growth and decay of current in LR circuit time constant, charge and discharge of a Capacitor through a resistance and inductance. Oscillations in an LC circuit. Alternating currents: Peak and RMS values and current and voltage, circuit containing LR, CR and LCR-Power factor, series and parallel LCR circuits, DC circuit, Ohm's law, resistivity, series and parallel combination, EMF, Kirchhoff's law, heating effect of current.	**8**
Module 3	**Electromagnetic waves:** Introduction, Maxwell's equation, electromagnetic waves, energy density and intensity, momentum, electromagnetic spectrum and radiation in Atmosphere.	**8**
Module 4	**Sound.** The nature and propagation of sound wave (the characteristics of sound, wave theory), speed of sound in a material medium, intensity of sound, the decibel, Interference of sound waves, beats, diffraction. Doppler's effect, Ultrasonic wave, production of ultrasonic waves (piezo-electric effect) in ultrasonography. Use of principle of Doppler's effect in Diagnostic Radiology (e.g. Echo, blood flow measurement).	**8**
Module 5	**Heat** Definition of heat, temperature, Heat capacity, specific heat capacity, Heat transferconduction, convection, radiation, thermal conductivity, equation for thermal conductivity (k), the value of k of various material of interest in radiology, thermal expansion, Newton's law of cooling, Heat radiation, perfect black body, Stefan law, application in Diagnostic Radiology (Heat dissipation in both stationary and rotating X-ray tubes).	**6**
Module 6	**Electronics.** Semiconductors; Conduction in crystals, Energy bands. Intrinsic and Extrinsic semiconductors n-type and p-type semiconductors, majority and minority carriers.	**10**

	Semiconductor diodes: p-n junction-properties forward and reverse bias, characteristics of p-n junction Rectifiers-Half-wave and full wave, ripple factor, Efficiency of HW and FW rectifiers. Filter circuits; Zener diode, regulated power supply. Transistors-Symbols, Transistor connections and characteristics, Transistor as an amplifier, load line analysis, operating point, types of amplifiers-voltage and power amplifiers. Feedback-negative feedback in amplifiers.	
	Total Numberof Lectures	**48**

Course Name: Conventional Radiography and Equipment
Course Code: BMRITC203

Course Type: Core (Theoretical)	Course Details: CC-8			L-T-P: 4 - 0 - 0	
Credit: 4	Full Marks: 100	CA Marks		ESE Marks	
		Practical	Theoretical	Practical	Theoretical
		….	30	….	70

Module	Topics	Number of Lecture
Module 1	Production of x-rays: X-ray tube, gas filled x-ray tube, construction working and limitations; stationary anode x - ray tube; construction, working, methods of cooling the anode, rating chart and cooling chart; rotating anode x - ray tube: construction, working rating chart, speed of anode rotation, angle of anode inclination, dual focus and practical consideration in choice of focus, anode heel effect, grid controlled x - ray tube; effect of variation of anode voltage and filament temperature; continuous and characteristics spectrum of x - rays, inherent filter and added filter, their effect on quality of the spectrum.	7
Module 2	High tension circuits: H.T. generator for x-ray machines, three phase rectifier circuits, three phase six rectifier circuit, three phase 12 rectifier circuit, high and medium frequency circuits; capacitance filter control and stabilizing equipment; mains voltage compensator, mains resistance compensator, compensation for frequency variation, control of tube voltage, kV compensator; high tension selector switch, filament circuit, control of tube current, space charge compensation.	7
Module 3	Meters and exposure timers: Moving coil galvanometer: construction and working/conversion to millimeter, ammeter and voltmeter, meters commonly used in diagnostic x-ray machines, pre reading kV meter and millimeter, digital panel meters. Clockwork timers, synchronous motor timer, electronic timers,	7

	photo metric timers (fluorescent and photoelectric effect as applied in timers), ion chamber based timers, integrated timer.	
Module 4	Interlocking circuits: Relays: description and working, use of relays in diagnostic machines for over load protection, circuit diagram; simplified circuit and block diagrams illustrating sequence of events from mains supply to controlled emission of x-rays.	6
Module 5	Control of scattered radiation: Beam limiting devices: cones, diaphragms, light beam collimator, beam centering device, methods to verify beam centering and field alignment; grids; design and control of scattered radiation, grid ratio, grid cut-off, parallel grid, focused grid, crossed grid, grided cassettes, stationary and moving grid potter bucky diaphragms, various types of grid movements; single stroke movement, oscillatory movement and reciprocatory movement.	7
Module 6	Fluoroscopy: Fluorescence and phosphorescence - description, fluorescent materials used in fluoroscopic screens, construction of fluoroscopic screen and related accessories, tilting table, dark adaptation. Image intensifier - Construction and working, advantages over fluoroscopic device, principles and methods of visualising intensified image, basic principles of closed circuit television camera and picture tube. Vidicon camera, CCD. Automatic brightness control, automatic exposure control, chamber selection during fluoroscopy. Serial radiography: Manual cassette changer, rapid automatic film changer, basic principles of cine fluoroscopy and angiography use of grid controlled x-ray tube.	7
Module 7	Care and Maintenance of X-ray equipment;General care; functional tests; testing the performance ofexposure timers, assessing the MA settings, testing the available KV, measurement of focal spot of an x-ray tube, testing the light beam diaphragm, practical precautions pertaining to Brakes and locks, H.T. cables, meters and controls, tube stands and tracks as well as accessory equipment.	7
	Total Numberof Lectures	**48**

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Course Name: Radiographic and Image Processing Techniques
Course Code: BMRITC204

Course Type: Core (Theoretical)	Course Details: CC-9			L-T-P: 4 - 0 - 0	
Credit: 4	Full Marks: 100	CA Marks		ESE Marks	
		Practical	Theoretical	Practical	Theoretical
		….	30	….	70

Module	Topics	Number of Lecture
Module 1	Appreciation and application of all the factors listed below will enable the student/technologist to produce X-ray films of good quality and diagnostic value. The lectures to be linked with practical demonstration to illustrate the importance of all that goes to make up correct exposure conditions.	4
Module 2	Radiographic Film: Structure of film emulsion-film characteristics (speed, base + fog, gamma, latitude)-effect of grain size on film response to exposure, interpretation of characteristics curve-Grain technology-Gelatin-Basic film types-Film formats and packing-Direct exposure duplitised films-Single coated emulsions-Films for specializeduse-manufacturing process. Structure, properties of different parts, handling, film wrappings. Handling of exposed and unexposed films. Types, applications, advantages/limitations of different types, safe light requirements.	4
Module 3	Sensitometer: Photographic density-characteristic curve-information from the characteristic curve-speed Vs definition. Storage of X-ray film.	4
Module 4	Control of scattered radiation: Methods of minimizing formation of scatter radiation, effectiveness of grids-grid ratio-preventing scattered radiation, use of cones, diaphragm light beam devices and effectiveness of collimation in reducing effects of scatter. Effects of scatter radiation on radiograph image quality, patient dose and occupational exposure.	4
Module 5	ntensifying screens: Structure and functions, common phosphors used-types, screen mounting, care and maintenance of film screen contact. Intensifying factor-speed and detail-crossover effect-resolution-mottle-reciprocity-screen asymmetry-cleaning. New phosphor technology-influence of kilo voltage. Photo-stimulable phosphor Imaging.	4
Module 6	Cassettes: Structure and function-Types-single, gridded, film holder-Design features and consideration with loading/unloading-Care and maintenance (cleaning).	4
Module 7	Photochemistry: Principles: Acidity, alkalinity, pH, the processing cycle, development, developer solution. Fixing, fixer solution, washing, drying replenishment, checking and adjusting-latent image formation--nature of development-constitution of developerdevelopment time-factors in the use of developer. Fixers-constitution of fixing solutionfactors affecting the fixer-replenishment of fixer-silver conservation-Drying-developer and fixer for automatic film processor-rinsing-washing and drying.	4

	Replenishment rates in manual and automatic processing-Silver recovery-Auto and manual chemicals.	
Module 8	Processing: manual processing-care of processing equipment-automatic processormanual VS automatic processing-principles and typical equipment Microprocessor controlled-Cine processing-Daylight systems-Processing faults-maintenance.	4
Module 9	**Automatic Film Processor.** Functions of various components. Film roller transport-transport time, film feed system. Importance and relation to temp, fixed and variable time cycles. Care and maintenance (cleaning routine and methods of cleaning). Radiographic image-components of image quality-unsharpness in radiographic imagecontrast of the radiographic image-distinctness of the radiographic image-size, shape and spatial relationships. Factors affecting Image Quality: Meaning of radiographic image contrast, density, resolution, sharpness, magnification and distortion of image, noise and blur. Radiographic illuminators and viewing conditions, visual acuity and resolution.	4
Module 10	Presentation of radiographs-opaque letters and markers-Identification of dental filmspreparation of stereo radiographs-viewing conditions. Monitor images-Characteristics of the video image-television camera-imaging camera. Laser-light and laser-laser imaging-laser imagers-imaging plates-Dry cameras.	4
Module 11	**Processing room** Dark Room: The processing area. Dark room design, construction, illumination, entrance safe lighting-types. Room storage, shelving of films.Cleaning and maintenance. Dark Room Planning: For A Small Hospital, for A Large Hospital Location of Dark Room and construction of Dark Room. Ventilation, Wall Protection Entrance to Dark Room - Single Door,Double Door, Labyrinth. Dark Room:Instruction to Staff, Dry Bench, Drawer, Cupboard. Loading and Unloading Cassettes. Hangers, Types of Hangers and Storage of Hangers Wet Bench Cleanliness, Control of Dust, Dark Room Sink Hatches and Drier Safe Lights, Direct and Indirect, Uses, Factors Affecting Safelight Performance, Safelight Tests. Viewing Room, Film Dispensing	8
	Total Numberof Lectures	**48**

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Course Name: Radiographic and Image Processing Techniques Practical
Course Code: BMRITC205

Course Type: Core (practical)	Course Details: CC-10			L-T-P: 0 - 0 - 4	
Credit: 2	Full Marks: 100	CA Marks		ESE Marks	
		Practical	Theoretical	Practical	Theoretical
		60	….	40	…..

Module	Topics	Number of Practical (D+P)
Module 1	Appreciation and application of all the factors listed below will enable the student/technologist to produce X-ray films of good quality and diagnostic value. The lectures to be linked with practical demonstration to illustrate the importance of all that goes to make up correct exposure conditions.	2+2
Module 2	Radiographic Film: Structure of film emulsion-film characteristics (speed, base + fog, gamma, latitude)-effect of grain size on film response to exposure, interpretation of characteristics curve-Grain technology-Gelatin-Basic film types-Film formats and packing-Direct exposure duplitised films-Single coated emulsions-Films for specializeduse-manufacturing process. Structure, properties of different parts, handling, film wrappings. Handling of exposed and unexposed films. Types, applications, advantages/limitations of different types, safe light requirements.	2+2
Module 3	Sensitometer: Photographic density-characteristic curve-information from the characteristic curve-speed Vs definition. Storage of X-ray film.	2+2
Module 4	Control of scattered radiation: Methods of minimizing formation of scatter radiation, effectiveness of grids-grid ratio-preventing scattered radiation, use of cones, diaphragm light beam devices and effectiveness of collimation in reducing effects of scatter. Effects of scatter radiation on radiograph image quality, patient dose and occupational exposure.	2+2
Module 5	Intensifying screens: Structure and functions, common phosphors used-types, screen mounting, care and maintenance of film screen contact. Intensifying factor-speed and detail-crossover effect-resolution-mottle-reciprocity-screen asymmetry-cleaning. New phosphor technology-influence of kilo voltage. Photo-stimulable phosphor Imaging.	2+2
Module 6	Cassettes: Structure and function-Types-single, gridded, film holder-Design features and consideration with loading/unloading-Care and maintenance (cleaning).	2+2

Module 7	Photochemistry: Principles: Acidity, alkalinity, pH, the processing cycle, development, developer solution. Fixing, fixer solution, washing, drying replenishment, checking and adjusting-latent image formation--nature of development-constitution of developerdevelopment time-factors in the use of developer. Fixers-constitution of fixing solutionfactors affecting the fixer-replenishment of fixer-silver conservation-Drying-developer and fixer for automatic film processor-rinsing-washing and drying. Replenishment rates in manual and automatic processing-Silver recovery-Auto and manual chemicals.	2+2
Module 8	Processing: manual processing-care of processing equipment-automatic processormanual VS automatic processing-principles and typical equipment Microprocessor controlled-Cine processing-Daylight systems-Processing faults-maintenance.	2+2
Module 9	**Automatic Film Processor.** Functions of various components. Film roller transport-transport time, film feed system. Importance and relation to temp, fixed and variable time cycles. Care and maintenance (cleaning routine and methods of cleaning). Radiographic image-components of image quality-unsharpness in radiographic imagecontrast of the radiographic image-distinctness of the radiographic image-size, shape and spatial relationships. Factors affecting Image Quality: Meaning of radiographic image contrast, density, resolution, sharpness, magnification and distortion of image, noise and blur. Radiographic illuminators and viewing conditions, visual acuity and resolution.	2+2
Module 10	Presentation of radiographs-opaque letters and markers-Identification of dental filmspreparation of stereo radiographs-viewing conditions. Monitor images-Characteristics of the video image-television camera-imaging camera. Laser-light and laser-laser imaging-laser imagers-imaging plates-Dry cameras.	2+2
Module 11	**rocessing room** Dark Room: The processing area. Dark room design, construction, illumination, entrance safe lighting-types. Room storage, shelving of films.Cleaning and maintenance. Dark Room Planning: For A Small Hospital, for A Large Hospital Location of Dark Room and construction of Dark Room. Ventilation, Wall Protection Entrance to Dark Room - Single Door,Double Door, Labyrinth. Dark Room:Instruction to Staff, Dry Bench, Drawer, Cupboard. Loading and Unloading Cassettes. Hangers, Types of Hangers and Storage of Hangers Wet Bench Cleanliness, Control of Dust, Dark Room Sink Hatches and Drier Safe Lights, Direct and Indirect, Uses, Factors Affecting Safelight Performance, Safelight Tests. Viewing Room, Film Dispensing	4+4
	Total Numberof Practicals	**48**

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PROGRAM OUTLINE

Semester III

Course Code	Course Name	L - T - P	Credits	Total Marks
BMRITC301	Pathology	4-0-0	4	100
BMRITC302	Clinical Radiography Positioning Part – I	4-0-0	2	100
BMRITC303	Clinical Radiography Positioning Part – I Practical	0-0-4	4	100
BMRITC304	Modern Radiological and Imaging Equipment	4-0-0	2	100
BMRITC305	Contrast and Special Radiography Procedure	4-0-0	4	100
BMRITC306	Contrast and Special Radiography Procedure Practical	0-0-4	4	100
GE		See pool	4	100
TOTAL			**24**	**700**

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Semester- III

Course Name: **Pathology**

Course Code: BMRITC301

Course Type: Core (Theoretical)	Course Details: CC-11			L-T-P: 4 - 0 - 0	
Credit: 4	Full Marks: 100	CA Marks		ESE Marks	
		Practical	Theoretical	Practical	Theoretical
		….	30	….	70

Module	Topics	Contact Hours
Module 1	General Pathology Adaptations, Cell Injury and Repair: Hyperplasia, atrophy, metaplasia, necrosis and apoptosis - Differences between apoptosis and necrosis.	5
Module 2	Acute and Chronic inflammation : Five cardinal signs of inflammation-Outcomes of acute inflammation- Chronic inflammation-Granulomatous inflammation-Acute phase oteins	4
Module 3	Tissue repair, regeneration and hemodynamic disorders : Cutaneous wound healingPathologic aspects of repair-Hyperaemia and congestion-Thrombosis and Virchow triadEmbolism-Infarction-Shock ; Bronchial asthma, COPD - Tumors	4
Module 4	Diseases of immune system : Hypersensitivity reaction-Type I, II, III, and IV hypersensitivity reactions Systemic Pathology	6
Module 5	RBC and Bleeding disorders: Anaemia – Definition and classification, WBC disorders: Leukocytosis, Leukemia – acute and chronic, Causes of splenomegaly Disease of the GIT Diseases of Liver, Biliary tract and Pancreas: Jaundice – classification based on pathophysiology	6

Module 6	Endocrine System: Diagnostic criteria of diabetes mellitus, Major subtypes of diabetes mellitus, Differences between type I and Type II diabetes mellitus, Complications of diabetes mellitus Systemic Path emphasis I	6
Module 7	Blood vessels: Atherosclerosis – Risk factors; American Heart association classification (1995) of Human atherosclerosis ;Hypertension – diagnostic criterion, types and causes ; Varicose veins; Thrombophlebitis and Phlebothrombosis The Heart: Heart failure; Myocardial infarction – causes, laboratory changes and complications; Corpulmonale; Rheumatic fever	6
Module 8	Diseases of the Lung: Chronic obstructive pulmonary disease; Asthma – pathogenesis; Pneumonia – lobar and bronchopneumonia; Lung carcinoma – Incidence and Causes Systemic Path emphasis II	5
Module 10	Systemic Path emphasis IV Nervous system : Intracerebral, Subarachnoid and Subdural haemorrhage, Meningitis and Encephalitis – Bacterial and viral causes and CSF findings; Epilepsy – Causes; Acute brain failure – Coma; Epilepsy – Classification terminology; CNS tumors – Classification terminology	6
	Total Number of Hours	**48**

Text Books:-

1. MARIANO S.H. DIFIORE: Atlas of Human Histology, 5th Ed. 1981, Lea and Feliger.
2. B.D. CHAURASIA: Handbook of General Anatomy, 2nd Ed., CBS Publishers and Distributors, New Delhi - 110 032.

Reference Books:-

1. PETER L. WILLIAMS AND ROGER WARWICK: - Gray's Anatomy - Descriptive and Applied, 36th Ed., 1980, Churchill Livingstone.
2. R. KANAGASUNTHARAM, P. SIVANANDA-SINGHAM & A. KRISHNAMURTI: Anatomy- Regional, Functional, & Clinical, P.G. Publisher, Singapore1987.

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Course Name: Clinical Radiography Positioning Part – I

Course Code: BMRITC302

Course Type: Core (Theoretical)	Course Details: CC-12			L-T-P: 4 - 0 - 0	
Credit: 4	Full Marks: 100	CA Marks		ESE Marks	
		Practical	Theoretical	Practical	Theoretical
		----	30	----	70

Module	Topics	Contact Hours
Module 1	**Skeletal system:** Upper limb: Technique for hand, fingers, thumb, wrist joint carpal bones, forearm, elbow joint, radio ulnar joints and humerus supplementary techniques for the above. E. g. Carpal tunnel view, ulnar groove, head of the radius, supracondylar projections.	4
Module 2	Lower limb: Technique for foot, toes, great toe, tarsal bones, calcaneum, ankle joint, lower leg, knee, patella & femur. Supplementary techniques: Stress view for torn ligaments, ● Subtalar joint and talo calcaneal joint. ● Inter condylar projection of the knee. ● Tibial tubercle. ● Length measurement technique.	4
Module 3	Shoulder girdle and thorax: Technique for shoulder joint, scapular, clavicle, acromio clavicular joints, sternum, ribs,sterno-clavicular joint. Supplementary projections and techniques Recurrent dislocation of shoulder. Traumatic dislocation of shoulder. Cervical ribs.	4

Module 4	Vertebral column: Technique for atlanto-occipital joint, cervical spine, cervico thoracic spine, thoracic spine, thoraco- lumber spine, lumbo sacral spine, sacrum and coccyx. Supplementary techniques to demonstrate: □ Scoliosis □ Kyphosis □ Spondylolisthesis □ disc lesion □ Union of spinal graft.	5
Module 5	Pelvic girdle and hip region: Technique for whole pelvis. Ilium, ischium, pubic bones, sacro iliac joint, symphysis pubis, hip joint, acetabulum neck of femur, greater and lesser trochanter. Supplementary techniques- □ Congenital dislocation of hips □ Epiphysis of femur □ Lateral projections for hip joints to show femoral head and neckrelationship.	4
Module 6	Skeletal survey: Skeletal survey for metabolic bone disease, metastases, hormonal disorder, renal disorders. Skull: Basic projections for cranium, facial bones, nasal bones and mandible. Technique for □ Petrous temporal for mastoids. Internal auditory canal. - Accessory nasal sinuses. □ Tempero - mandibular joint. - Orbits and optic foramen.- Zygomaticarches. □ Styloid process. - Pituitary fossa. - Jugular foramen	6
Module 7	**Dental Radiography-** Technique for intra oral full mouth.- Occlusal projections.- Extra oral projections including orthopantomography.- Supplementary techniques.	4
Module 8	**Upper respiratory system-** Technique for post nasal airways, larynx, trachea, thoracic inlet, Valsalva manoeuvre. - Phonation.	4

Module 9	**Lungs and Mediastinum:** Technique for routine projections- Supplementary projections: Antero-posterior, obliques, lordotic, apical projection, use of penetrated postero-anterior projection. - Expiration technique. - Technique for pleural fluid levels and adhesions.	5
Module 10	**Abdominal viscera-** Technique for plain film examination. - Projection for acute abdomen patients. - Technique to demonstrate: Foreign bodies, Imperforate anus.	4
Module 11	**Radiography using mobile X-ray equipment-** Radiography in the ward: Radiography in the specialized unit, such as: Intensive care unit, Coronary care, Neonatal unit.-Radiography in the operating theatre.	4
	Total Number of Hours	**48**

Text Books:-

1. MARIANO S.H. DIFIORE: Atlas of Human Histology, 5th Ed. 1981, Lea and Feliger.
2. B.D. CHAURASIA: Handbook of General Anatomy, 2nd Ed., CBS Publishers and Distributors, New Delhi - 110 032.

Reference Books:-

1. PETER L. WILLIAMS AND ROGER WARWICK: - Gray's Anatomy - Descriptive and Applied, 36th Ed., 1980, Churchill Livingstone.
2. R. KANAGASUNTHARAM, P. SIVANANDA-SINGHAM & A. KRISHNAMURTI: Anatomy- Regional, Functional, & Clinical, P.G. Publisher, Singapore1987.

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Course Name: Clinical Radiography Positioning Part – I Practical
Course Code: BMRITC303

Course Type: Core (Practical)	Course Details: CC-13			L-T-P: 0 - 0 - 4	
Credit: 2	Full Marks: 100	CA Marks		ESE Marks	
		Practical	Theoretical	Practical	Theoretical
		60	….	40	….

Radiographic positioning of all parts of the body.

Text Books:-

1. L Prakasam reddy, Fundamentals of Medical Physiology, 4th Edition, Paras medical Publisher, Hyderabad,2008
2. Sujit K. Chaudhuri, Concise Medical Physiology, 6th edition, New Central Book Agency, Kolkata, 2008

Reference Books:-

1. A C Guyton: Text book of Medical Physiology, 8th edition, saunders company, Japan

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Course Name: Modern Radiological and Imaging Equipment
Course Code: BMRITC304

Course Type: Core (Theoretical)	Course Details: CC-14			L-T-P: 4 - 0 - 0	
Credit: 4	Full Marks: 100	CA Marks		ESE Marks	
		Practical	Theoretical	Practical	Theoretical
		----	30	----	70

Module	Topics	Contact Hours
Module 1	Special radiological equipment: Portable and mobile x-ray units, dental x-ray machine, skull table mammographic device - Technical aspects of Mammography;	6
Module 2	High Tension Generators, x-ray tubes-their types and advancements; Accessories; Resolution; Quality control; Application and role in medicine. , digital radiography equipment, digital subtraction techniques.	6
Module 3	Tomography: Body section radiography, basic principle and equipment, multi section tomography, various types of tomographic movements,Tomosynthesis, Stich radiography, Dual energy x-ray absorptionometry (DEXA) scan.	6
Module 4	Computed radiography: its principle, physics & equipment. Digital .	6
Module 5	Radiography. Flat panel digital fluoroscopy and radiography system, Direct and indirect digital radiography and fluoroscopy systems	6
Module 6	Digital radiography and Computed radiography its advantages, disadvantages and applications.	6
Module 7	Vascular Imaging Equipment: Introduction, historical developments, Principle, scanned projection radiography, digital subtraction angiography, applications and definition of terms,	6
Module 8	Picture archiving and communication system (PACS)	6
	Total Number of Hours	**48**

Text Books:-

1. L Prakasam reddy, Fundamentals of Medical Physiology, 4th Edition, Paras medical Publisher, Hyderabad,2008
2. Sujit K. Chaudhuri, Concise Medical Physiology, 6th edition, New Central Book Agency, Kolkata, 2008

Reference Books:-

2. A C Guyton: Text book of Medical Physiology, 8th edition, saunders company, Japan

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Course Name: Contrast and Special Radiography Procedure

Course Code: BMRITC305

Course Type: **Core (Theoretical)**	Course Details: **CC-15**			L-T-P: **4- 0 - 0**	
Credit: **4**	Full Marks: **100**	CA Marks		ESE Marks	
		Practical	Theoretical	Practical	Theoretical
		….	**30**	….	**70**

Module	**Topics**	**Contact Hours**
Module 1	Responsibility of Radiographer during Radiological Procedures. Preparation of Patient for Different Procedures. Contrast Media - Positive and Negative, Ionic & Non – Ionic Adverse Reactions To Contrast Media and Patient Management Emergency Drugs in the Radiology Department Emergency Equipments In the Radiology Department Aseptic technique	4
Module 2	Indications, contraindications, basic techniques and relationships to other techniques of the following special procedures **Gastrointestinal Tract:** Fluoroscopy, general considerations, responsibility of radiographers Barium swallow, pharynx and oesophagus Barium meal and follow through Hypotonic duodenography Small bowel enema Barium Enema routine projections for colon and rectum, colonic activators; double contrast studies; colostomy. Special techniques for specific disease to be examined Water soluble contrast media - eg. gastrograffin studies **Salivary glands:** Routine technique, procedure – sialography	6
Module 3	**Biliary system:** Plain film radiography Intravenous cholangiography Percutaneous cholangiography Endoscopic retrograde cholangio-pancreatography (ERCP) Operative cholangiography Post-Operative cholangiography (T - tube Cholangiography	4
Module 4	**Urinary system:** Intravenous urography Retrograde pyelography Antegrade pyelography Cystography and micturating cystouresthrography Urethrography (ascending) Renal puncture	6
Module 5	**Female reproductive system:** Hysterosalpingography. **Mammography:** Mammography: Basic views, special views, wire localization. Ductography. **Respiratory system:** Bronchography: Awareness. **Sinusography:** Routine technique and procedure.	4

Module 6	**Tomography:** General principles. Estimation, selection of depth of layer. Layer thickness required for different examination. Spacing of layers. Types and advantages of various movements. Choice of tomographic movement- exposure factor. Sequential, horizontal and multi section tomography. Application of tomography to specific regions.	6
Module 7	**Microradiography:** General principles. Requirement. Equipment. Technique.	4
Module 8	**Soft Tissue Radiography:** High and low kilo voltage technique; differential filtration. Non - screen technique - simultaneous screen and non -screen technique. Multiple radiography. Uses of soft tissue radiography.	4
Module 9	**High kV Radiography:** General principles Relation to patient dose Change in radiographic contrast. Scatter elimination; beam collimation; grid ratio. Speed and type of grid movement. Radiographic factor; application and uses.	6
Module 10	**Localization of foreign bodies:** General location principles. Ingested; inhaled; inserted; embedded foreign bodies. Foreign bodies in eye. Preparation of the area to be investigated. Appropriate projection for all Techniques to locate non-opaque foreign body.	4
	Total Number of Hours	**48**

Course Name: Contrast and Special Radiography Procedure Practical

Course Code: BMRITC306

Course Type: Core (Practical)	Course Details: BMRITC-16			L-T-P: 0 - 0 - 4	
Credit: 2	Full Marks: 100	CA Marks		ESE Marks	
		Practical	Theoretical	Practical	Theoretical
		60	….	40	….

Same as Theory

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Semester IV

Course Name - Physics of Newer Imaging Modalities
Course Code- BMRITC401

Course Type: Core (Theory)	Course Details: BMRITC-17			L-T-P: 4 - 0 -0	
Credit: 4	Full Marks: 100	CA Marks		ESE Marks	
		Practical	Theoretical	Practical	Theoretical
		….	30	….	70

Module	Topics	Number of Lecture
Module 1	Computed Tomography its principle, various generations and advancements	6
Module 2	Magnetic Resonance Imaging- its principle, advancements and applications.	6
Module 3	Ultrasonography, Color Doppler- its principle, advancements and applications.	6
Module 4	Digital Radiography and Digital subtraction angiography equipment- principle, advancements and applications.	6
Module 5	Fusion Imaging including PET-CT, PET- MRI.	6
Module 6	Digital Mammography, DEXA equipment- principle, advancements and applications.	6
Module 7	Tele radiology HIS,RIS and PACS,	6
Module 8	Image processing in digital radiography systems: Post processing techniques in console using CR, DR and flat panel fluoroscopy systems	6
	Total Number of Hours	**48**

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Course Name- Clinical Radiography Positioning Part 2
Course Code- BMRITC402

Course Type: Core (Theory)	Course Details: BMRITC-18			L-T-P: 4 - 0 -0	
Credit: 4	Full Marks: 100	CA Marks		ESE Marks	
		Practical	Theoretical	Practical	Theoretical
		….	30	….	70

Module	Topics	Number of Lecture
Module 1	Radiography technique comprising of the complete Radiography of Skull and Radiography of cranial bones; including special techniques for sella turcica, orbits, opticforamina, superior orbital fissure and inferior orbital fissure etc.	6
Module 2	Facial bones; Paranasal sinuses, Temporal bone and Mastoids. Dental Radiography: Radiography of teeth-intra oral, extra oral and occlusal view.	6
Module 3	Abdomen: Preparation of patient. General abdominal radiography and positioning for fluid and air levels. Plain film examination. Radiography of female abdomen to look for pregnancy. Radiography in case of acute abdomen.	6
Module 4	Macroradiography: Principle, advantage, technique and applications. Stereography - Procedure - presentation, for viewing, stereoscopes, stereometry.	6
Module 5	High KV techniques principle and its applications. Soft tissue Radiography including Mammography - its techniques, equipment,advancements and applications. Localization of foreign bodies. Various techniques Ward /mobile radiography - electrical supply, radiation protection, equipment and instructions to be followed for portable/ward radiography.	6
Module 6	Operation theatre techniques: General precautions, Asepsis in techniques - Checking of mains supply and functions of equipment, selection of exposure factors, explosion risk, radiation protection and rapid processing techniques.	6
Module 7	Trauma radiography/Emergency radiography Neonatal and Paediatric Radiography, Tomography and Tomosynthesis Dual energy X-ray absorptiometry	6
Module 8	Forensic Radiography	6
	Total Number of Lecture	**48**

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Course Name- Clinical Radiography Positioning Part 2-Practical
Course Code- BMRITC403

Course Type: Core (Practical)	Course Details: BMRITC-19			L-T-P: 0 - 0 -4	
Credit: 2	Full Marks: 100	CA Marks		ESE Marks	
		Practical	Theoretical	Practical	Theoretical
		60	….	40	….

Module	Topics	Number of Practical (D+P)
Module 1	Radiography technique comprising of the complete Radiography of Skull and Radiography of cranial bones; including special techniques for sella turcica, orbits, optic foramina, superior orbital fissure and inferior orbital fissure etc.	3+3
Module 2	Facial bones; Paranasal sinuses, Temporal bone and Mastoids. Dental Radiography: Radiography of teeth-intra oral, extra oral and occlusal view.	3+3
Module 3	Abdomen: Preparation of patient. General abdominal radiography and positioning for fluid and air levels. Plain film examination. Radiography of female abdomen to look for pregnancy. Radiography in case of acute abdomen.	3+3
Module 4	Macroradiography: Principle, advantage, technique and applications. Stereography - Procedure - presentation, for viewing, stereoscopes, stereometry.	3+3
Module 5	High KV techniques principle and its applications. Soft tissue Radiography including Mammography - its techniques, equipment,advancements and applications. Localization of foreign bodies. Various techniques Ward /mobile radiography - electrical supply, radiation protection, equipment and instructions to be followed for portable/ward radiography.	3+3
Module 6	Operation theatre techniques: General precautions, Asepsis in techniques - Checking of mains supply and functions of equipment, selection of exposure factors, explosion risk, radiation protection and rapid processing techniques.	3+3

Module 7	Trauma radiography/Emergency radiography Neonatal and Paediatric Radiography, Tomography and Tomosynthesis Dual energy X-ray absorptiometry	3+3
Module 8	Forensic Radiography	3+3
	Total Number of Practical	**48**

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Course Code- BMRITC404
Course Name- Modern Radiological & Imaging Techniques including Patient Care

Course Type: Core (Theory)	Course Details: BMRITC-20			L-T-P: 4 - 0 -0	
Credit: 4	Full Marks: 100	CA Marks		ESE Marks	
		Practical	Theoretical	Practical	Theoretical
		….	30	….	70

Module	Topics	Number of Lecture
Module 1	**Interventional Radiography:** (Basic angiography and DSA) History , technique, patient care Percutaneous catherisation, catheterization sites, Asepsis Guidewire, catheters, pressure injectors, accessories Use of digital substraction- single plane and bi-plane All forms of diagnostic procedures including angiography, angioplasty, bilary examination, renal evaluation and drainage procedure.	4
Module 2	**Central Nervous System:** Myelography Cerebral studies Ventriculography Arthrography: Shoulder, Hip, Knee, Elbow	4
Module 3	**Angiography:** Carotid Angiography (4 Vessel angiography) Thoracic and Arch Aortography Selective studies: Renal, SMA, Coeliac axis Vertebral angiography Femoral arteriography	4

	Angiocardiography	
Module 4	**Venography:** Peripheral venography Cerebral venography Inferior and superior venocavography Relevant visceral phlebography	4
Module 5	**Cardiac catheterization procedures:** PTCA, BMV, CAG, Pacemaker, Electrophyiology,	4
Module 6	**Patient care in Medical Imaging Department** Hospital procedure: Hospital staffing and organization; records relating to patients and departmental statistics; professional attitude of the technologist to patients and other members of the staff; medico- legal aspects; accidents in the departments, appointments, organization; minimizing waiting time; out-patient and follow-up clinics; stock-taking and stock keeping.	4
Module 7	Care of the patient : FIRST contact with patients in the department; management of chair and stretcher patients and aids for this, management of the unconscious patient; elementary hygiene; personal cleanliness; hygiene in relation to patients (for example clean linen and receptacles , nursing care; temperature pulse and respiration; essential care of the patient who has a tracheostomy; essential care of the patient who has a colostomy; bedpans and urinals; simple application of a sterile dressing.	4
Module 8	First aid: Aims and objectives of first aid; wounds and bleeding, dressing and bandages; pressure and splints, supports etc. Shock; insensibility; asphyxia; convulsions; resuscitation, use of suction apparatus, drug reactions; prophylactic measures; administration of oxygen; electric shock; burns; scalds; hemorrhage; pressure points; compression band. Fractures; splints, bandaging; dressing, foreign bodies; poisons.	4
Module 9	Infection: Bacteria, their nature and appearance; spread of infections; auto-infection or cross-infection; the inflammatory process; local tissue reaction, general body reaction; ulceration; asepsis and antisepsis. Universal precautions, hospital acquired infectionsHIV, Hepatitis B, C, and MRSA etc.	4
Module 10	Principles of asepsis: Sterilization - methods of sterilization; use of central sterile supply department; care of identification of instruments, surgical dressings in common use, including filamented swabs, elementary operating theatre procedure; setting of trays and trolleys in the radio imaging department (for study by radio imaging students only)	4
Module 11	Departmental procedures: Department staffing and organisations; records relating to patients and departmental statistics; professional attitudes of the technologist to patients and other members of the staff, medico-legal aspects accidents in the department;appointments; organisations; minimizing waiting time; out-	4

	patient and follow-up clinics; stock taking and stock keeping.	
Module 12	Drugs in the department: Storage: classification; labelling and checking, regulations regarding dangerous and other drugs; units of measurement, special drugs, antidepressive, anti-hypertensive etc.	4
	Total Number of Lectures	**48**

Course Code: BMRITC405
Course Name: Quality Control in Radiology and Radiation Safety

Course Type: Core (THEORY)	Course Details: CC-21			L-T-P: 4 - 0 - 0	
Credit: 4	Full Marks: 100	CA Marks		ESE Marks	
		Practical	Theoretical	Practical	Theoretical
		------	30	------	70

Module	Topics	Number of Lecture
Module 1	**Quality Control:** Objectives of quality Controls: Improve the quality of imaging thereby increasing the diagnostic value; to reduce the radiation exposure; Reduction of film wastage and repeat examination; to maintain the various diagnostic and imaging units at their optimal performance.	4
Module 2	Quality assurance activities: Equipment selection phase; Equipment installation and acceptance phase; Operational phase; Preventive maintenance.	4
Module 3	Quality assurance programme at the radiological faculty level: Responsibility; Purchase; Specifications; Acceptance; Routine testing; Evaluation of results of routine testing; Quality assurance practical exercise in the X ray generator and tube; Image receptors from processing; Radiographic equipment; Fluoroscopic equipment; Mammographic equipment; Conventional tomography; Computed tomography; Film processing, manual and automatic; Consideration for storage of film and chemicals; Faults tracing; Accuracy of imaging-	4

	image distortion for digital imaging devices. LASER printer calibration	
Module 4	Quality assurance programme tests: General principles and preventive maintenance for routine, daily, weekly, monthly, quarterly, annually – machine calibration. Basic concepts of quality assurance – LASER printer - Light beam alignment; X-ray out-put and beam quality check; KVp check; Focal spot size and angle measurement; Timer check; mAs test; Grid alignment test; High and low contrast resolutions; Mechanical and electrical checks; Cassette leak check; Proper screen-film contact test; Safe light test; Radiationproof test; Field alignment test for fluoroscopic device; Resolution test; Phantom measurements - CT, US and MRI.	4
Module 5	Quality assurance of film and image recording devices: Sensitometry; Characteristic curve; Film latitude; Film contrast; Film speed Resolution; Distortion; Artifacts of films and image recording. Monitor calibration. SMPTE pattern	4
Module 6	Maintenance and care of equipment: Safe operation of equipment; Routine cleaning of equipment and instruments; Cassette, screen maintenance; Maintenance of automatic processor and manual processing units; Routine maintenance of equipments; Record keeping and log book maintenance; Reject analysis and objectives of reject analysis programme.	4
Module 7	Care and maintenance of diagnostic equipment: General principles and preventive maintenance for routine - daily, Weekly, monthly, quarterly, annually: care in use, special care of mobile equipment.	4
Module 8	**Radiation safety in diagnostic Radiology:** Radiation Quantities and Units: Radiation- Radioactivity- Sources of radiation - natural radioactive sources -cosmic rays terrestrial radiation - - man made radiation sources. Units of radiation - Quality factor - Flux- Fluence-Kerma-Exposure- Absorbed doseEquivalent Dose- Weighting Factors-Effective Dose - Occupational Exposure Limits -Dose limits to public.	4
Module 9	Biological Effects of radiation: Ionization, excitation and free radical formation, hydrolysis of water, action of radiation on cell Chromosomal aberration and its application for the biological dosimetry- Effects of whole body and acute irradiation, dose fractionation, effects of ionizing radiation on each of major organ system including fetus -Somatic effects and hereditary effects- stochastic and deterministic effects-Acute exposure and chronic exposure-LD50 - factors affecting radio sensitivity. Biological effects of non-ionizing radiation like ultrasound, lasers, IR, UV and magnetic fields.	4
Module 10	Radiation detection and Measurements: Ionization of gases- Fluorescence and Phosphorescence -Effects on photographic emulsion. Ionization Chambers –proportional counters- G.M counters- scintillation detectors – liquid semiconductor detectors – Gamma ray spectrometer. Measuring systems – free air ionization chamber –thimble ion chamber – condenser chamber – Secondary standard dosimeters – film dosimeter – chemical	4

	dosimeter- Thermo luminescent Dosimeter. -Pocket dosimeterRadiation survey meter- wide range survey meter -zone monitor-contamination monitor -their principle function and uses. Advantages & disadvantages of various detectors & its appropriateness of different detectors for different type of radiation measurement. Dose and Dosimetry, CT Dose Index (CTDI, etc.), Multiple Scan Average Dose (MSAD), Dose Length Product (DLP), Dose Profile, Effective Dose, Phantom Measurement Methods, Dose for Different Application Protocols, Technique Optimization. Dose area product in fluoroscopy and angiography systems, AGD in mammography.	
Module 11	Radiation protection: Radiation protection of self and patient- Principles of radiation protection, time - distance and shielding, shielding - calculation and radiation survey –ALARA- personnel dosimeters (TLD and film batches) - occupational exposure.	4
Module 12	Radiation Hazard evaluation and control: Philosophy of Radiation protection, effects of time, Distance & Shielding. Calculation of Work load, weekly calculated dose to radiation worker & General public Good work practice in Diagnostic Radiology. Planning consideration for radiology, including Use factor, occupancy factors, and different Shielding material.	4
	Total Number of Lecture	**48**

Course Code: BMRITC406
Course Name: Clinical Posting

Course Type: Core (practical)	Course Details: CC-22			L-T-P: 0 - 0 - 8	
Credit: 4	Full Marks: 100	CA Marks		ESE Marks	
		Practical	Theoretical	Practical	Theoretical
		60	------	40	------

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Semester V

Course Code: BMRITC501
Course Name: Cross-sectional Anatomy and Physiology

Course Type: Core (THEORY)	Course Details: CC-23			L-T-P: 4 - 0 - 0	
Credit: 4	Full Marks: 100	CA Marks		ESE Marks	
		Practical	Theoretical	Practical	Theoretical
		------	30	----	70

Module	Topics	Contact Hours
Module 1	Identify cross-sectional anatomy in the sagittal, coronal and axial planes on CT and MR images.	5
Module 2	Describe anatomical structural relationships. Recognize normal anatomy and build a personal resource system for future study.	5
Module 3	Locate and identify pertinent cerebral, upper thorax, mid-thorax, and abdominal anatomy. On CT and MR images, identify anatomical structures of the body and of the head.	5
Module 4	Distinguish between arterial and venous anatomy of the entire body's vascular system. Classify the various sections of anatomical regions and their associated parts.	5
Module 5	Introduction to Sectional Anatomy & Terminology- Sectional planes, Anatomical relationships/terminology	4
Module 6	Divisions of the mid-thorax, heart and great vessels- Lungs, heart and great vessels, Esophagus	4
Module 7	Anatomy of the upper thorax- Surface anatomy relationships, Bony structures and muscles, Blood vessels.	4

Module 8	CT/MRI Images of the Thorax - Normal and pathologic Anatomy of the Abdomen- Major organs and their accessories, Abdominal blood vessels	4
Module 9	CT/MR Images of Abdomen - Normal and pathologic Anatomy of the Pelvis- Bony structures and associated muscles, Digestive and urinary systems	4
Module 10	Reproductive Organs CT/MR Images of the Male/Female Pelvis- Normal and pathologic Neuro Anatomy- Scan planes	4
Module 11	Brain - Cerebral hemispheres, Sinuses, Ventricles, Brainstem and associated parts, Arterial/venous systems, Basal ganglia, Cranial nerves Spine- Vertebra and disc, Spinal cord and meninges Neck- Arterial/venous systems, Muscles, Glands and pharynx	4
	Total Number of Hours	48

Course Code: BMRITC502
Course Name: Radiographic Techniques of Advanced Imaging Technology

Course Type: Core (THEORY)	Course Details: CC-24		L-T-P: 4 - 0 - 0	
Credit: 4	Full Marks: 100	CA Marks	ESE Marks	
		Practical	Theoretical	Practical	Theoretical
		------	30	----	70

Module	Topics	Contact Hours
Module 1	Ultrasonography/ Doppler studies: Techniques of sonography-selection-	3
Module 2	USG: Preparations -instructions and positioning of patient for TAS, TVS, TRUS, neck USG and extremities- patient care and maintenance protocols clinical applications display methods –quality image reproducible extend – biopsy procedures, assurance to patients.	8
Module 3	CT scan studies acquisition/ protocols /techniques: CT of head and neck – thorax – abdomen – pelvis – musculo skeletal system – spine – PNS.	8

Module 4	Anatomy – clinical indications and contraindications – patient preparation – technique –contrast media-types, dose, injection technique; timing, sequence - image display – patient care –utilization of available techniques & image processing facilities to guide the clinician- CT anatomy and pathology of different organ systems.	8
Module 5	MRI Scanners: Methods of MRI imaging methods – Head and Neck ,Thorax, Abdomen, Musculoskeletal System imaging - Clinical indications and contraindications-	8
Module 6	Types of common sequences effects of sequence on imaging - Protocols for various studies- slice section- patient preparation-positioning of the patient - patient care- calibration - paramagnetic agents and dose, additional techniques and recent advances in MRI -	6
Module 7	Image acquisition-modification of procedures in an unconscious or un co-operative patient - plain studies- contrast studies -special procedures reconstructions- 3D images- MRS blood flow imaging, diffusion/perfusion scans - strength and limitations of MRI- role of radiographer.	7
	Total Number of Hours	48

Course Code: BMRITC503
Course Name: Radiographic Techniques of Advanced Imaging Technology-Practical

Course Type: Core (PRACTICAL)	Course Details: CC-25			L-T-P: 0 - 0 - 4	
Credit: 2	Full Marks: 100	CA Marks		ESE Marks	
		Practical	Theoretical	Practical	Theoretical
		60	----------	40	----

ACCORDING TO THEORY

Course Code: BMRITC504
Course Name: Regulatory Requirements in Diagnostic Radiology & Imaging Technology

Course Type: Core (THEORY)	Course Details: CC-26		L-T-P: 4 - 0 - 0
	Full Marks:	CA Marks	ESE Marks

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Credit: 4	100	Practical	Theoretical	Practical	Theoretical
		----	30	----	70

Module	Topics	Contact Hours
Module 1	Regulatory Bodies & regulatory Requirements:	5
Module 2	International Commission on Radiation Protection (ICRP) / National Regularity body (AERB - Atomic Energy Regulatory Board) -.	6
Module 3	Responsibilities, organization, Safety Standard, Codes and Guides,	6
Module 4	Responsibilities of licenses, registrants & employers and Enforcement of Regulatory requirements	6
Module 5	Role of Radiographer in Planning, QA & Radiation Protection: Role of technologist in radiology department - Personnel and area monitoring., Setting up of a new X-Ray unit, staff requirement,	7
Module 6	AERB specifications for site planning and mandatory guidelines – Planning of X-ray rooms, dark rooms – Inspection of X-Ray installations -	6
Module 7	Registration of X-Ray equipment installation- Certification -Evaluation of workload versus radiation factors –Occupational exposure and protection Tools/devices. ICRP, NRPB, NCRP	7
Module 8	WHO guidelines for radiation protection, pregnancy and radiation protection. NABH guidelines, AERB guidelines, PNDT Act and guidelines	5
	Total Number of Hours	**48**

Course Name: **Clinical posting**
Course Code: BMRITC505

Course Type: Core (Practical)	Course Details: CC-27			L-T-P: 0 - 0 - 8	
Credit: 4	Full Marks: 100	CA Marks		ESE Marks	
		Practical	Theoretical	Practical	Theoretical
		60	----	40	----

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Course Name: **Research Methodology and Biostatistics**

Course Code: BMRITSE501

Course Type: Core (Theoretical)	Course Details: SEC-1			L-T-P: 3 - 1 - 0	
Credit: 4	Full Marks: 100	CA Marks		ESE Marks	
		Practical	Theoretical	Practical	Theoretical
		....	30	....	70

Module	Topics	No of lectures
Module 1	Introduction to research methods	4
Module 2	Identifying research problem	4
Module 3	Ethical issues in research	4
Module 4	Research design	4
Module 5	Basic Concept of Bio-statistics Need of biostatistics	4
Module 6	Types of Data Research tools and Data collection methods Documentation of collected data	4
Module 7	Sampling methods	4
Module 8	Developing a research proposal	4
Module 9	Understanding data in biostatistics How to get relevant data	4
Module 10	Relation between data & variables Type of variables: defining data set	4

Module 11	Collection of relevant data: sampling methods Construction of study: population, sample, normality etc.	4
Module 12	Summarizing data on the pretext of underlined study Significance of statistical analysis	4
	Total Number of Hours	**48**

Text Book

Methods in Biostatistics for Medical students and research workers-7th Ed.	B. K. Mahajan
Reference Book	
Introduction to Biostatistics	Ornaldo Wayne

GENERAL ELECTIVE GEC
Course code- See Pool.

Course Type: Core (Theory)	Course Details: GEC4			L-T-P: SEE POOL	
Credit: 4	Full Marks: 100	CA Marks		ESE Marks	
		Practical	Theoretical	Practical	Theoretical
		---	30	----	70

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Semester VI

Course Code: BMRITC601

Course Name: Quality Assurance & Radiation Safety (AERB Guidelines) in Diagnostic Radiology

Course Type: Core (THEORY)	Course Details: CC-28			L-T-P: 4 - 0 - 0	
Credit: 4	Full Marks: 100	CA Marks		ESE Marks	
		Practical	Theoretical	Practical	Theoretical
		------	30	----	70

Module	Topics	Number of lecture
Module 1	Quality Assurance and quality control of Modern Radiological and Imaging Equipment	6
Module 2	Quality control of Digital Radiography and Computed Radiography	7
Module 3	Quality control of CT scan and PACS	7
Module 4	Quality control of Ultrasonography	7
Module 5	Quality control of MRI Scanner	7
Module 6	Quality control of Image artifacts their different types, causes, and remedies	7
Module 7	Newer Radiation safety protocols and recent advances in radiation safety including AERB guidelines.	7
	Total Number of Lectures	**48**

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Course Code: BMRITC602

Course Name: Quality Assurance & Radiation Safety (AERB Guidelines) in Diagnostic Radiology- Practical

Course Type: Core ((PRACTICAL)	Course Details: CC-29			L-T-P: 0 - 0 - 4	
Credit: 2	Full Marks: 100	CA Marks		ESE Marks	
		Practical	Theoretical	Practical	Theoretical
		60	------	40	----

Module	Topics	Number of Practical (D+P)
Module 1	Quality Assurance and quality control of Modern Radiological and Imaging Equipment	3+3
Module 2	Quality control of Digital Radiography and Computed Radiography	3+4
Module 3	Quality control of CT scan and PACS	3+4
Module 4	Quality control of Ultrasonography	3+4
Module 5	Quality control of MRI Scanner	3+4
Module 6	Quality control of Image artifacts their different types, causes and remedies	3+4
Module 7	Newer Radiation safety protocols and recent advances in radiation safety including AERB guidelines.	3+4
	Total Number of Practical	**48**

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Course Code: BMRITC603
Course Name: Patient Safety Management.

Course Type: Core (THEORY)	Course Details: CC-30			L-T-P: 4 - 0 - 0	
Credit: 4	Full Marks: 100	CA Marks		ESE Marks	
		Practical	Theoretical	Practical	Theoretical
		---------	30	----	70

Module	Topics	Number of theory
Module 1	Radiation protection.	4
Module 2	Drug and contrast issues.	4
Module 3	Patient handling.	4
Module 4	Informed consent and explanatory information for patients.	4
Module 5	MRI safety.	4
Module 6	Prevention of infection, decontamination, hospital-acquired infections.	4
Module 7	Appropriate professionalism	4
Module 8	Interventional radiology.	4
Module 9	Communication.	3
Module 10	Quality Improvement.	3
Module 11	Fatigue/ burnout/ radiation exposure	4
Module 12	Patient safety issues.	3
Module 13	Protection of children and other vulnerable persons.	3
	Total Number of Theory	**48**

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Course Code: BMRITC604
Course Name: Hospital Practice & Patient care

Course Type: Core (THEORY)	Course Details: CC-31			L-T-P: 4 - 0 - 0	
Credit: 4	Full Marks: 100	CA Marks		ESE Marks	
		Practical	Theoretical	Practical	Theoretical
		----------	30	----	70

Module	Topics	Number of lecture
Module 1	Hospital staffing and administration, records, professional, ethics, co-operation with other staff and departments, Departmental organisations.	6
Module 2	Handling of the patients, seriously ill and traumatized patients, visually impaired, speech and hearing impaired, mentally impaired, drug addicts and non-English speaking patients.	6
Module 3	Understanding patient needs - patient dignity of inpatient and out patients.	6
Module 4	Interaction with the patient's relatives and visitors. Methods of effective communication - verbal skills, body language, professional appearance, visual contact etc.	6
Module 5	Elementary personal and departmental hygiene, dealing with receptacles, bed pans and urinal etc. General preliminaries to the exam. Moving chair and stretcher, patient. Unconscious patient, general comfort and reassurance for the patient. Vital signs and oxygen - patient's Haemeatasis status.	6
Module 6	Body temp, respiratory rate, pulse, blood pressure, oxygen therapy, oxygen devices,Chest tubes and lines. First aid - shock, electrical shock, haemorrhage, burns, Asphyxia, fractures, loss of consciousness. Emergency treatment to the collapsed patient.	6
Module 7	Artificial respiration and resuscitation. Preparation of patient for general and special radiological examinations. Supervision of patients undergoing special examination.	6
Module 8	Administration of drugs and contrast media. Aseptic and sterile procedures. Handling of infections patients in the department or in the ward. Regulation of dangerous drugs. Trolley set up for special x-ray examinations, Radiation hazardous and protective measures.	6
	Total Number of Lecture	**48**

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Course Code: BMRITC605

Course Name: Clinical posting

Course Type: Core (PRACTICAL)	Course Details: CC-32			L-T-P: 0 - 0 - 8	
Credit: 4	Full Marks: 100	CA Marks		ESE Marks	
		Practical	Theoretical	Practical	Theoretical
		60	----	40	----

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Course Code: BMLTSE601
Course Name: MEDICAL LAW AND ETHICS

Course Type: Core (THEORY)	Course Details: SEC-2			L-T-P: 3 – 1 - 0	
Credit: 4	Full Marks: 100	CA Marks		ESE Marks	
		Practical	Theoretical	Practical	Theoretical
		----	30	----	70

Module	Topics	Number of Lecture
Module 1	• **Medical ethics** Definition - Goal - Scope Basic principles of medical ethics – Confidentiality Introduction to Code of conduct • **Malpractice and negligence** Rational and irrational drug therapy	7
Module 2	• **Autonomy and informed consent** Right of patients Care of the terminally ill- Euthanasia Organ transplantation • **Medico legal aspects of medical records** Medico legal case and type- Records and document related to MLC - ownership of medical records - Confidentiality Privilege communication - Release of medical information - Unauthorized disclosure - retention of medical records - other various aspects.	7
Module 3	• **Introduction to Quality and patient safety** Concepts of Quality of Care Quality Improvement Approaches Standards and Norms Quality Improvement Tools Introduction to NABH guidelines	7
Module 4	**Basics of emergency care and life support skills** - Basic life support (BLS) is the foundation for saving lives following cardiac arrest. Fundamental aspects of BLS include immediate recognition of sudden cardiac arrest (SCA) and activation of the emergency response system, early cardiopulmonary resuscitation (CPR), and rapid defibrillation with an automated external defibrillator (AED). Initial recognition and response to heart attack and stroke are also considered part of BLS. The student is also expected to learn about basic emergency care including first aid and triage. Topics to be covered under the subject are as follows: a. Vital signs and primary assessment b. Basic emergency care – first aid and triage	7

	c. Ventilations including use of bag-valve-masks (BVMs) d. Choking, rescue breathing methods e. One- and Two-rescuer CPR f. Using an AED (Automated external defibrillator). g. Managing an emergency including moving a patient	
Module 5	**Bio medical waste management and environment safety** The aim of this section will be to help prevent harm to workers, property, the environment and the general public. Topics to be covered under the subject are as follows: Definition of Biomedical Waste, Types of waste generated from Health Care Facility Waste minimization BMW – Segregation, collection, transportation, treatment and disposal (including color coding) Liquid BMW, Radioactive waste, Metals / Chemicals / Drug waste BMW Management & methods of disinfection Modern Technology for handling BMW Use of Personal protective equipment (PPE) Monitoring & controlling of cross infection (Protective devices)	7
Module 6	**Infection prevention and control** The objective of this section will be to provide a broad understanding of the core subject areas of infection prevention and control and to equip AHPs with the fundamental skills required to reduce the incidence of hospital acquired infections and improve health outcomes. Concepts taught should include – Evidence-based infection control principles and practices [such as Sterilization, Disinfection, Effective hand hygiene and use of Personal Protective Equipment (PPE)], Guidelines (NABH and JCI) for Hospital Infection Control	7
Module 7	**Professionalism and values** Professional values- Integrity, Objectivity, Professional competence and due care, Confidentiality Personal values- ethical or moral values Attitude and behavior- professional behavior, treating people equally Code of conduct , professional accountability and responsibility, misconduct Differences between professions and importance of team efforts Cultural issues in the healthcare environment	6
	Total Number of Hours	**48**

KAZI NAZRUL UNIVERSITY
School of Health Science and Technology Department
of Allied Health Science and Technology
UG Learning Outcome Based Curriculum (LOCF) for B.Sc in Medical Radiology and Imaging Technology

Program outline

Semester VII

Course Code	**Course Name**	L - T - P	Credits	Total Marks
BMRITC701	Internship -I	0-0-12	6	100
BMRITC702	Project Work -I	0-0- 6	3	100
Total			9	200

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Course Name: Internship-I

Course Code: BMRITC701

Course Type: Core (Practical)	Course Details: CC-33			L-T-P: 0 - 0 - 12	
Credit: 6	Full Marks: 100	CA Marks		ESE Marks	
		Practical	Theoretical	Practical	Theoretical
		60	....	40	....

Course Name: Project work I

Course Code: BMRITC702

Course Type: Core (Practical)	Course Details: CC-34			L-T-P: 0 - 0 - 6	
Credit: 3	Full Marks: 100	CA Marks		ESE Marks	
		Practical	Theoretical	Practical	Theoretical
		60	....	40	....

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Semester VIII

Program outline

Course Code	**Course Name**	L - T - P	Credits	Total Marks
BMRITC801	Internship -I	0-0-12	6	100
BMRITC802	Project Work -I	0-0- 6	3	100
Total			9	200

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Course Name: **Internship-II**
Course Code: BMRITC801

Course Type: Core (Practical)	Course Details: CC-35			L-T-P: 0 - 0 - 12	
Credit: 6	Full Marks: 100	CA Marks		ESE Marks	
		Practical	Theoretical	Practical	Theoretical
		60	....	40	....

Course Name: **Project work II**
Course Code: BMRITC802

Course Type: Core (Practical)	Course Details: CC-36			L-T-P: 0 - 0 - 6	
Credit: 3	Full Marks: 100	CA Marks		ESE Marks	
		Practical	Theoretical	Practical	Theoretical
		60	....	40	....