

Curriculum and Credit Framework

For

Bachelors in Medical Radiology & Imaging Technology (BMRIT)

(To be effective from the Academic Session 2025-26)



Faculty of Life Sciences
Gurugram University, Gurugram
(A State Govt. University Established Under Haryana Act 17 Of 2017)

Md. Badiyah Anishti	Kaisha Na Nankoli	Dr. Gopinna Srinivasan	Dr. Himanshu Thakral
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APPROVED SYLLABUS 2025

Ministry of Health & Family Welfare

**Bachelor in Medical Radiology & Imaging Technology
(BMRIT)**

Md. Imtiaz Ansari	Kalpna Bansal	Dr. Geeta Srivastava	Dr. Anand Thakral
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Teaching faculty and infrastructure (minimum standard to start the programmes):

Institute should mandatorily be associated with the state medical colleges whereby they can make use of the available patient load and medical infrastructure as a part of their training curriculum (May be through MOU).

- Standalone institutions must have an MoU with either a medical college or hospital or healthcare facility as per the guidelines (desired number of Radiology equipment/beds/OPD etc.) defined in the curriculum to ensure practical exposure to the students.
- MoU to also define the radiology clinical supervision of the students –institutional staff or clinical preceptors can be considered.

For the institutes to be capable of providing high quality training to the student and exposure to all the related modalities, it should have the following:

- X-ray Unit (CR, DR)
- Mobile X-ray unit
- Fluoroscopic unit
- Ultrasonography, Color Doppler Equipment
- Multi-slice C.T. Scan,
- Mammography
- DEXA
- MRI
- DSA

The teaching faculty (with annual intake of up to 20 students or students' staffs' ratios must be 5:1 to be maintained) for the MRITs should have a minimum of Master in the MRIT or MRIT with PhD in relevant subject.

- 1 Professor
- 1 Assoc. Professor
- 3 Asst. Professor
- 2 demonstrators

Method of teaching and learning-

- Lecture
- Tutorial
- Problem based learning
- Small group teaching and learning
- Continuous interactive learning
- Case-based
- Project based
- Research project- Research was considered by the group to be very important in order to keep pace with other professions and to generate a research background for our own profession.
- Seminars
- Clinical conferences
- E-learning
- Skills laboratory
- Industrial visit

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Admission of Lateral Entry candidates:

Number of intakes: lateral entry admission must not be more than 10% of the annual intake.

Lateral entry to second year for allied and healthcare science courses for candidates who have passed diploma program from the Government Boards and recognized by State/Central University, fulfilling the conditions specified and these students are eligible to take admission on lateral entry system only if the same subject have been studied at diploma level.

There may be need of deliberation on the inclusion of a few bridging courses are advisable for those having less qualified subjects.

A candidate with a minimum 2 years full-time diploma in Medical Imaging Technology/Radiography recognized by a Government Body is eligible for lateral entry to the 3rd semester.

Note: Candidates with minimum 2 years full-time diploma in Medical Imaging Technology/Radiography from a recognized Government Body shall have passed 'plus-two' [10+2] with Physics, Chemistry and Biology as subjects with minimum 1 years of radiology working experience in hospital/academic institution or Candidates with minimum 3 years full-time diploma in Medical Imaging Technology/Radiography from a recognized Government Body shall have passed 'plus-two' [10+2] with Arts/Commerce as subjects, should have studied Physics, Chemistry and Biology as principal subjects during the tenure of the Medical Imaging Technology course with minimum 1 years of radiology working experience in hospital/academic institution. Eligibility of the lateral candidates based on examination conducted by NCAHP.

Foreign nationals and candidates who have qualified from a foreign University/Board should obtain permission from the NCAHP commission prior to the admission for equivalence of the qualification.

Note: Curriculum task force members decided not to submit the Diploma of MRIT curriculum and requested NCAHP to phase out the course within five years. (As it was decided during the previous meeting).

Duration of the course

Duration of the course: 3 years (6 semesters) + 1 year (7th and 8th semester) internship. Total 4 years or 8 semesters programme. (per semester 640 hours of Theory & Practical hours) and 2400 hours of internship.

Total hours of the course: 6240 hours.

Medium of instruction:

English shall be the medium of instruction for all the subjects of study and for examination of the course.

Maximum period for completion of the course:

- The maximum period for completion of BMRIT is 7 years.
- If a candidate does not complete within the 6 years, he/she should re-register.

Attendance and Monitoring progress of studies:

- A candidate shall study in concerned department of the Institute for the entire period as a full-time student.
- A candidate who has a minimum of 75% attendance in theory and practical separately and who has fulfilled other requirements of the course shall be permitted to appear for examination.
- A candidate having shortage of attendance shall repeat the exam when it is offered next.



Attendance and appearance for Exam:

Candidates not possessing required attendance in a particular course as prescribed by university will not be allowed to take up examinations and has to appear for supplementary examination whenever board conducts exam for the particular course very next time.

Structure of the program**Overview**

Foundation courses (12 credits)	<ol style="list-style-type: none"> 1. Human Anatomy 2. Physiology 3. Pathology 4. Basics of Microbiology 5. Basics of Biochemistry
Core courses (109 credits)	<ol style="list-style-type: none"> 1. Basics of Radiation Physics 2. Conventional Radiography and Equipment 3. Clinical Radiography Positioning (Part 1) 4. Clinical Radiography Positioning (Part 2) 5. Radiography and Image Processing Techniques 6. Contrast Media and Special Radiological procedures 7. Cross Sectional Anatomy 8. Modern Radiological Imaging Equipment and Physics 9. Interventional Radiology Techniques 10. Patient Care in Radiology 11. Basics Techniques in CT Technology 12. Radiation safety in Diagnostic Radiology 13. Quality Assurance in Diagnostic Radiology and Regulatory Requirements 14. Basics Techniques in MRI Technology 15. Introduction to Nuclear Medicine Techniques 16. Ultrasound Techniques
Programme Courses (09 Credits)	<ol style="list-style-type: none"> 1. Introduction to Healthcare 2. Medical Terminology and Record Keeping 3. Basic Computers and Information Science 4. Medical Law and Ethics 5. Professionalism and Values 6. Principals of Management 7. English and Communication Skills 8. Biostatistics and Research Methodology
40 Credits	Internship
Total credits: 170	

Distribution of Credits:

L – Lectures- 1 hour: 1 credit, T – Tutorial- 1 hour: 1 credit, P – Practical -2hours: 1 credit

C - Clinical (Studentship)- 3 hours: 1 credit



11.	BMRIT Radiology Clinical Education – part I (studentship)	--	--	--	15	5	--	--	--	--	--	--	--	--	--	--
Total			15	--	21	23	30	300	700	1000	500	30	70	100	50	1100

Student Contact Hours Per Week: 15Hrs.Theory and 21Hrs. Practical of 60 minutes each

Medium of Instruction: English

Total Marks: 1100


Abbreviations: ESE- End Semester Exam, CIE- Continuous Internal Evaluation, L – Lectures ((hrs./week), T - Tutorial, P – Practical
{Clinical / Practical (hrs./week)}

*Internal Assessment, # External Assessment.

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Teaching and Examination Scheme																
Course Name: Bachelor in Medical Radiology and Imaging Technology																
Duration of Program: Four Years (Eight Semesters)													Pattern: Full Time			
Duration: 18 Weeks													Semester: Third			
S.N.	Course Title	Course Code	Teaching Scheme				Examination Scheme								Grand Total	
			L (hrs./week)	T	C/P (hrs./week)	Credits (L+T+P)	Theory				Practical					
							Exam Duration in Hrs.	CIE	ESE	Total	CIE	ESE	Total			
								Max Marks	Max Marks	Max Marks	Min Marks	Max Marks	Max Marks	Max Marks		Min Marks
1.	Pathology	BMRIT-015	2	--	--	2	3	30	70	100	50	--	--	--	--	100
2.	Clinical Radiography Positioning (Part II)	BMRIT-016	2	1	6	6	3	30	70	100	50	30	70#	100	50	200
3.	Radiography and Image Processing Techniques	BMRIT-017	2	--	2	3	3	30	70	100	50	--	--	--	--	100
4.	Contrast Media & Special Radiological procedures	BMRIT-018	2	1	6	6	3	30	70	100	50	30	70#	100	50	200
5.	BMRIT Radiology Clinical Education – part III (studentship)		--	--	12	4	--	--	--	--	--	--	--	--	--	--
Total			8	2	26	21	12	120	280	400	200	60	140	200	100	600

Student Contact Hours Per Week: 08Hrs. Theory, 02Hrs. Tutorial and 26 Hrs. Practical of 60 minutes each
Medium of Instruction: **English** Total Marks: **600**
Abbreviations: ESE- End Semester Exam, CIE- Continuous Internal Evaluation, L - Lectures, T - Tutorial, P - Practical
*Internal Assessment, # External Assessment.
*Internal Assessment (Institutional Level examination) marks are not to be counted for the grade at the end of the semester.



Teaching and Examination Scheme																	
Course Name: Bachelor in Medical Radiology and Imaging Technology																	
Duration of Program: Four Years (Eight Semesters)										Pattern: Full Time Semester: Fifth							
Duration: 18 Weeks																	
S.N.	Course Title	Course Code	Teaching Scheme					Examination Scheme									Grand Total
			Theory (hrs./week)	Tutorial	C/P (hrs./week)	Credits (L+T+P)	Exam Duration in Hrs.	Theory				Practical					
								CIE	ESE	Total	Min Marks	CIE	ESE	Total			
														Max Marks	Max Marks	Max Marks	
1.	Basics Techniques in CT Technology	BMRIT-023	4	1	8	9	3	30	70	100	50	30	70#	100	50	200	
2.	Radiation Safety in Diagnostic Radiology	BMRIT-024	2	1	4	5	3	30	70	100	50	30	70#	100	50	200	
3.	Quality Assurance in Diagnostic Radiology and Regulatory Requirements	BMRIT-025	1	1	2	3	3	30	70*	100	50	--	--	--	--	100	
4.	BMRIT Radiology Clinical Education – part V (studentship)		--	--	12	4	--	--	--	--	--	--	--	--	--	--	
	Total		7	3	26	21	09	90	210	300	150	60	140	200	100	500	

Student Contact Hours Per Week: 07Hrs. Theory, 03Hrs. Tutorial and 26 Hrs. Practical of 60 minutes each
Medium of Instruction: **English** Total Marks: 500
Abbreviations: ESE- End Semester Exam, CIE- Continuous Internal Evaluation, L - Lectures, T - Tutorial, P - Practical
*Internal Assessment, # External Assessment.
*Internal Assessment (Institutional Level examination) marks are not to be counted for the grade at the end of the semester.



Studentship or observership must include:

- A minimum of 14 hours per week is considered as studentship in every semester.
- Provide simulation and skill labs for practicing skills specific to the program in the initial years of observership/studentship.
- Every semester must have seminars/workshops on new developments/ technologies. Check annexure for marking criteria.
- If the clinical facility is not within the same campus, transportation should be provided to the students and interns.
- All practical skills must be supervised and recorded in a Logbook and skills to be evaluated after the completion of the internship.

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2. COMPETENCY

Identify the Anatomy to be imaged, properly position the patient for Imaging, correctly select appropriate projection/projections to demonstrate the area of interest Use appropriate radiographic/radiological and imaging parameters.

3. COURSE OUTCOMES

On completion of this subject, the student should be able to:

- Correctly Identify the Anatomy to be imaged
- To properly position the patient for radiography/Radiological and Imaging procedures
- Correctly select appropriate projection/projections to demonstrate the area of interest
- Use appropriate radiographic parameters to produce a radiographic image with satisfactory results
- Should be able to differentiate a properly positioned and exposed radiographic image from a wrongly positioned and over or underexposed radiographic image
- Should be able to correctly identify anatomical features displayed in radiographic image obtained.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme			Credit	Examination Scheme													
L	T	P	(L+T+P)	Paper Hrs.	Theory						Practical						
					CIE		ESE		Total		CIE		ESE*		Total		
					Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	
--	--	--	20	--	--	--	--	--	--	--	--	100	50	100	50	200	100

Note: ESE will be conducted immediate after end of the 7th & 8th semester at the institutional level.*

Legends: L-Lecture, T – Tutorial/Teacher Guided Theory Practice, P –Practical, ESE -End Semester Examination, CIE- Continuous Internal Evaluation

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6. EXPECTATIONS FROM Skill Knowledge Partner (SKP)

Helping institute in developing the following competencies among students

- Soft Skills i.e. Communication, Presentation and others.
- Life Skills i.e. Time management, Safety, Innovation, Entrepreneurship, Team building and others
- Hands-on Practices i.e. Patient Safety, Radiography/Radiological and Imaging and Quality Assurance aspects.

7. ROLE OF PARENT DEPARTMENT OF THE INSTITUTE

1. Identify Hospitals/Diagnostic Centers available for training along with capacity.
2. Institutions have to enter in to MOU with number of SKPs (Institutes/Hospitals/Diagnostic Centers) for accommodating all the enrolled students for the mandatory internship
3. Student and mentor allocation as per the slots available for Hands on training (Desirable mentor-student ratio is 1:10).
4. Communication with Institutes/Hospitals/Diagnostic Centers available for training along with capacity and its confirmation.
5. Student enrollment for training.
6. Issuing letter to the Institutes/Hospitals/Diagnostic Centers for the training along with details of students and mentors.
7. Principal/ HOD/ Faculty should address students about safety norms, rules and discipline to be maintained in the Institutes/Hospitals/Diagnostic Centers during the training before relieving students for training.
8. The designated faculty member would visit the Institutes/Hospitals/Diagnostic Centers periodically to check the progress of the student in the training, his/ her attendance, discipline, log book preparation & project report preparation
9. Mentors to carry out progressive assessment of the students during the training through Continuous Internal Evaluation (CIE), End Semester Examination (ESE) assessment by mentor along with Institutes/Hospitals/Diagnostic Centers expert as external examiner

8. ROLES AND RESPONSIBILITIES OF THE STUDENTS

Following should be informed to students in the letter deputing them for the training; an undertaking for this should also be taken from them

- Students would interact with the mentor to suggest choices for suitable Institutes/Hospitals/Diagnostic Centers. If students have any contact in Institutes/Hospitals/Diagnostic Centers (through their parents, relatives or friends) then same may be utilized for securing placement for themselves and their peers.
- Students have to fill the forms duly signed by authorities along with training letter and submit it to training officer in the Institutes/Hospitals/Diagnostic Centers on the first day of training. Student should also carry with him/her the Identity card issued by institute during training period.
- He/she will have to get all the necessary information from the training officer regarding schedule of the training, rules and regulations of the Institutes/Hospitals/Diagnostic Centers and safety procedures to be followed. Student is expected to observe these rules, regulations, procedures.



10. SUGGESTED LEARNING STRATEGIES

Students should visit the website of the Institutes/Hospitals/Diagnostic Centers where they are undergoing training to collect information about Facilities, Specialization, capacity, number of employees, etc. They should also refer the operating manuals of the major machines and operation, testing, quality control and standard operating procedures and practices used in the Radiology. Students may also visit websites related to other similar industries as their learning resource. The training activity may vary according to nature and size of Institutes/Hospitals/Diagnostic Centers. The details of activities to be completed during 6 months should be planned appropriately. The evaluation of Clinical Education (Internship) will be done on the basis of skills acquired by the student during this 6-month period.

ASSESSMENT SCHEME FOR CLINICAL EDUCATION (INTERNSHIP)

Training duration	CONTINUOUS INTERNAL EVALUATION (Weekly report of all 6 months and attendance)		END SEMESTER ASSESSMENT (Practical and Oral)		Total marks	
	Max. marks	Min. marks	Max. marks	Min. marks	Max. marks	Min. marks
6 months	100	50	100	50	200	100

EVALUATION SHEET FOR CONTINUOUS INTERNAL EVALUATION

Sr. No.	Enrollment Number	Name of Student	Seminar/presentation in workshop or conference	Marks by Supervisor	Marks by Mentor Faculty	Total Marks
			Out of 40 (A)	Out of 30 (B)	Out of 30 (C)	Out of 100 (A+B+C)

Marking criteria for seminar/presentation at workshop/conference and marking criteria for supervisor/mentor faculty mentioned in the log book template.

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First Semester



II	<p>Locomotion and Support</p> <p>Cartilage – types, examples and histology</p> <p>Bone – classification, examples and histology. Parts of long bone, names of all bones, vertebral column and intervertebral disc. Fontanel's of fetal skull.</p> <p>Joints – classification of joints with examples, typical synovial joint (in detail). Muscular system – classification of muscular tissue and histology</p> <p>Important muscles of the body- Sternocleidomastoid, Trapezius, Muscles of tongue, Deltoid, Biceps brachii, Intercostal muscles, Thoracic diaphragm, Rectus abdominis, External oblique, Internal oblique, Transversus abdominis, Pelvic diaphragm, Gluteus maximus, Gluteus medius, Gluteus Minimus, Quadriceps femoris, Soleus.</p>	08	14
III	<p>Cardiovascular System</p> <p>Heart – size, location, chambers, exterior and interior, Blood supply of heart, Pericardium, Systemic and pulmonary circulation, Branches of aorta - common carotid artery, subclavian artery, Axillary artery, brachial artery, radial artery, superficial palmar arch, femoral artery, popliteal artery, dorsalis pedis artery., Peripheral pulse, Inferior venacava, portal vein, portosystemic anastomosis, Great saphenous vein, median cubital vein, Dural venous sinuses, Lymphatic system – cisterna chyli and thoracic duct, Lymphatic tissues and its histology, Regional lymph nodes – cervical, axillary and inguinal lymph nodes.</p> <p>Respiratory System</p> <p>Parts of RS – nose, nasal cavity, paranasal air sinuses, larynx, trachea, lungs, pleura, bronchopulmonary segments, Histology of trachea and lungs.</p>	08	20
IV	<p>Gastro-Intestinal System Theory</p> <p>Parts of GIT- oral cavity (lip, cheek, tongue, salivary glands, palate, dentition) pharynx (Waldeyer's ring) esophagus, stomach, small and large intestine and appendix, Liver, gall bladder, pancreas and spleen, Histology of esophagus, stomach, small and large intestine, liver, gall bladder and pancreas.</p> <p>Peritoneum</p> <p>Description of reflection, folds and pouches in brief.</p>	08	14
V	<p>Urinary System</p> <p>Kidney, ureter, urinary bladder, male and female urethra, Histology of kidney, ureter and urinary bladder.</p> <p>Reproductive System</p> <p>Parts of male reproductive system- testis, vas deferens, epididymis, prostate, Parts of female reproductive system- uterus, fallopian tubes, ovary, mammary gland, Histology of testis, vas deferens, epididymis, prostate, uterus, fallopian tube and ovary.</p>	08	20

Sr. No		Hours
5.	Demonstration of parts of urinary system, Histology of kidney, ureter, urinary bladder, Radiographs of abdomen – IVP, retrograde cystogram: Demonstration of section of male and female pelvis with organs in situ, Histology of testis, vas deferens, epididymis, prostate, uterus, fallopian tube and ovary, Radiographs of pelvis – Hysterosalpingogram. Demonstration of the glands, Histology of pituitary, thyroid, parathyroid, suprarenal glands.	1
6.	Demonstration of Histology of peripheral nerve and optic nerve, Demonstration of major nerves in the body, Demonstration of cranial cavity and parts of brain, Histology of cerebrum, cerebellum, spinal cord Demonstration of Histology of thin and thick skin, Demonstration of histology of cornea and retina.	1
	Total	6
Demonstration will be part of theory/tutorial classes. There is in separate credit for the practicals /demonstrations.		

Evaluation System
Continuous Internal Evaluation (CIE)

Sl. No.	Component	Marks	Weightage	IA marks
1.	Sessional test(s)			
	Two Written tests Same pattern as Summative test Average of two to be considered Absence without prior permission to be marked as 0	50		
	Total	50	0.3	15
2.	Continuous assessment			
	Seminars/Case presentations/ Logbook/ Case records/Record book/assignment			
	Total	50	0.3	15
	Total CIE marks			30

SUGGESTED LEARNING RESOURCES

S.No.	Title of Book	Author	Publication
1	Human Anatomy, Vol.1,2 &3, 5th edition, 2010,	B.D. Chaurasia	CBS publishers & distributors Pvt. Ltd.
2	Physiology & Anatomy with Practical Considerations	Ester. M. Grishcimer	J.P. Lippincott. Philadelphia
3	Manipal Manual of Anatomy, 2nd edition, 2012	Sampath Madhyastha	CBS publishers & distributors Pvt. Ltd
4	Text Book of General Anatomy, 2nd edition, 2013	Shobha Rawlani and Shival Rawlani	Jaypee brothers
5	Langman's Medical Embryology, 11th edition, 2009	T.W Sadler	Wolters Kluwer


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Unit	Topic and contents	Hours	Marks
I	<p>General physiology</p> <p>Introduction to Physiology, Concept of Homeostasis, cell – Morphology – Functions of organelles and Cell membrane, Transport mechanisms, Body fluid compartments.</p> <p>Muscle nerve physiology</p> <p>Neurons: Morphology, Action Potential, Neuroglia: Types & functions, Muscles: Types, structure of sarcomere. Neuromuscular junction, sliding filament mechanism of contraction.</p> <p>Blood</p> <p>Composition, properties, functions. Plasma proteins: Concentrations and functions, RBC: Morphology, functions, count, physiological variations and life span Erythropoiesis – stages, essential factors, regulation of Erythropoiesis, Hemoglobin: Functions, concentration, physiological variations. Fate of Hemoglobin – Jaundice, types, Color index, MCH, MCV, MCHC, PCV – normal values, WBC: Morphology, functions of all types including T & B lymphocytes, total and differential counts, physiological variations, Platelets: Morphology, count, functions, thrombocytopenia & bleeding time, Blood groups: Basis of blood grouping. Landsteiner's laws, ABO system, determination of blood groups, blood transfusion, complications of incompatible blood transfusion, Rh group, erythroblastosis foetalis, prevention and treatment, Blood bank.</p> <p>Haemostasis: Mechanisms. Clotting mechanism: factors, intrinsic and extrinsic pathways.</p> <p>Disorders of clotting – hemophilia, vitamin K deficiency. Anticoagulants – mechanism of action and their uses, Anemia: Classification – Morphological and Etiological, Blood volume: normal values.</p>	10	15
II	<p>Cardiovascular system</p> <p>Organization of cardiovascular system, greater and lesser circulation, Physiological anatomy of the heart, nerve supply, Junctional tissues of heart (pacemaker), Cardiac cycle: Mechanical events, Heart sounds, causes, characteristics and significance, Normal ECG, clinical significance of ECG, Heart rate – Physiological variations, Cardiac output: Definitions, normal values, physiological variations, Arterial blood pressure: Definitions, normal values, physiological variations, factors maintaining blood pressure. Role of baroreceptors in regulation of blood pressure.</p>	10	10
III	<p>Respiratory system</p> <p>Respiratory and non-respiratory function of respiratory system. Physiological anatomy of respiratory system Functions of respiratory</p> 	8	10

	<p>cretinism, Grave's disease, Adrenal cortex: hormones, functions of cortisol and aldosterone. Addison's disease, Cushing's syndrome, Adrenal medulla: actions of adrenaline and noradrenaline, Endocrine pancreas: Insulin & glucagon, functions, Regulation of blood glucose level, diabetes mellitus, Parathyroid: Functions of PTH.</p> <p>Nervous system</p> <p>Synapse: Types, Transmission, Sensory receptors: Definition, Classification Organization of spinal cord, Functions of Dorsal column and Spinothalamic tract,</p> <p>Functions of Corticospinal tract, Reflex Action: Definition, reflex arc, Functions of Cerebellum, Basal ganglia, Thalamus, Hypothalamus, Cerebral cortex:</p> <p>Lobes & functions. EEG – Definition and uses, Autonomic nervous system: Organization & functions, Cerebrospinal fluid: Composition and function.</p>		
VII	<p>Special senses</p> <p>Vision: Physiological anatomy of eye ball, rods & cones, Refractive errors: Myopia, hypermetropia, presbyopia & astigmatism, Audition: Functions of outer, middle & inner ear, cochlea, Deafness – types, Taste: Taste buds, primary taste sensation, Smell: Receptors, modalities of smell</p> <p>Reproductive system</p> <p>Male reproductive system: functions of testes, puberty, spermatogenesis functions of testosterone, semen, Female reproductive system: Ovarian hormones functions – Menstrual cycle, Hormonal basis of changes in menstrual cycle, Family Planning.</p>	10	10
Total		54	70

Suggested Practicals/Demonstration

	SUGGESTED PRACTICALS/DEMONSTRATION	Hours
	<p>Study of Microscope and its uses</p> <p>Collection of blood and study of hemocytometer</p> <p>Hemoglobinometry</p> <p>Determination of RBC count</p> <p>Determination of WBC count</p> <p>Determination of blood groups</p> <p>Determination of bleeding time</p>	8

End Semester Evaluation (ESE)**Written Paper**


Type of question	No. of questions	Marks per question	Total
Essay Question (EQ)	3 (to answer 2)	10	20
Short Essay Question (SEQ)	9 (to answer 7)	5	35
Short Answer Question (SAQ)	7 (to answer 5)	3	15
Total marks			70
Duration (minutes)			150

Question Paper Blueprint

Unit		Marks ($\pm 5\%$)
1.	General physiology, Muscle nerve physiology, Blood	18
2.	Cardiovascular system	14
3.	Respiratory system	14
4.	Excretory system	9
5.	Digestive system	9
6.	Endocrine system, Nervous system	18
7.	Special senses, Reproductive system	14
Total Marks (including optional questions)		96

Suggested Learning Resources

S.No.	Title of Book	Author	Publication
1	Foundation of Anatomy and Physiology	Ross Wilson	Churchill Livingstone.
2	Physiology & Anatomy with Practical Considerations	Ester. M. Grishcimer	J.P. Lippincott. Philadelphia
3	Text Book of Physiology	A. P. Krishna	Suman Publication
4	Text Book of Physiology	A.K. Jain	Avichal Publishing Company;

Unit	Topic and contents	Hours
I	<p>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.</p>	5
II	<p>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.</p> <p>Electromagnetic waves: Introduction, Maxwell's equation, electromagnetic waves, energy density and intensity, momentum, electromagnetic spectrum and radiation in Atmosphere.</p>	6
III	<p>Electronics</p> <p>Semiconductors; Conduction in crystals, Energy bands. Intrinsic and Extrinsic semiconductors n-type and p-type semiconductors, majority and minority carriers. 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.</p> <p>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.</p>	5
IV	<p>Discovery of x-rays-X-ray production and properties: Bremsstrahlung radiations-Characteristics X-Rays, factors affecting X-ray emission spectra, X-ray quality and quantity, HVL measurements, heel effect, soft and hard X-Rays, added and inherent filtration, reflection and transmission targets.</p>	5
V	<p>Heat</p> <p>Definition of heat, temperature, Heat capacity, specific heat capacity, Heat transfer-conduction, 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).</p>	4
VI	<p>Interaction of ionizing radiation with matter-Types of interactions of X-and gamma radiation, Photoelectric & Compton, Pair production, annihilation radiation.</p> <p>Interaction of X and gamma rays: Transmission through matter, law of exponential attenuation, half value layer, and linear attenuation coefficient-coherent scattering-photonuclear disintegration-Particle interactions. Interactions of X rays and Gamma rays in the body; fat-soft tissue-bone-contrast media-total attenuation coefficient-relative clinical importance.</p> 	5

End Semester Evaluation (ESE)**Written Paper**

Type of question	No. of questions	Marks per question	Total
Essay Question (EQ)	3 (to answer 2)	10	20
Short Essay Question (SEQ)	9 (to answer 7)	5	35
Short Answer Question (SAQ)	7 (to answer 5)	3	15
Total marks			70
Duration (minutes)			150

End Semester Evaluation (ESE)


There shall be practical examination for 70 marks in the subject.

Distribution of marks for ESE practical exams:

ESE		CIE		Grand total
Practical	Viva		Sub Total	
50	20	30	100	100

Question Paper Blueprint

Unit	Marks ($\pm 5\%$)
Basic concepts	10
Electricity and magnetism, Electromagnetic waves	10
Electronics	06
Discovery of x-rays-X-ray production and properties	25
Heat	06
Interaction of ionizing radiation with matter-	25
Exponential attenuation, Physical quantity, its unit and measurement	14
Total Marks (including optional questions)	96



Subject: Introduction to Healthcare

Subject Code: BMRIT - 004

RATIONALE

The course provides the students a basic insight into the main features of Indian health care delivery system and how it compares with the other systems of the world.

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme
L	T	P	C	
1	--	--	1	Institute level exam only: The Institute level examination will be held before the commencement of the University examinations. A Pass in the subject with a minimum of 50 marks (50% of the total 100 marks) is compulsory in order to be eligible for the award of degree. These marks will not be considered for the award of class. Supplementary examination shall be conducted by the Institute for the benefit of unsuccessful candidates. Supplementary examinations will be conducted within six weeks/six months from the date of announcement of results.

L, lecture; T, Tutorial; P, Practical

THEORY COMPONENTS

The following topics/subtopics should be taught and assessed in order to attain the identified competency.

Topic and contents	Hours
Introduction to Health: Definition of Health, Determinants of Health, Health indicators of India, Health team concept National Health Policy National Health Programs (Brief objectives and scope) Family welfare programs in India Introduction to Nursing: Nursing and Nursing principles, Interpersonal relationships, Bandaging basic turns, Bandaging extremities, Triangular bandages and their applications Nursing position, bed making, prone, lateral, dorsal, dorsal re-cumbent, Fowler's position, comfort measures, Aids, rest and sleep Lifting and transporting patients, transferring patients to wheel chair, transferring from bed to stretcher Bedside Management: Proper usage of bed pan, Observation of stools, urine, sputum. Understand the use and care of catheters. Enema procedures Method of giving nourishment: Feeding, tube feeding, drips, transfusion	18

Subject: Medical Terminologies and Record Keeping**Subject Code: BMRIT - 005****RATIONALE**

This course introduces the elements of medical terminology. Emphasis is placed on building familiarity with medical words through knowledge of roots, prefixes, and suffixes.

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme
L	T	P	C	
1	--	--	1	Institute level exam only: The Institute level examination will be held before the commencement of the University examinations. A Pass in the subject with a minimum of 50 marks (50% of the total 100 marks) is compulsory in order to be eligible for the award of degree. These marks will not be considered for the award of class. Supplementary examination shall be conducted by the Institute for the benefit of unsuccessful candidates. Supplementary examinations will be conducted within six weeks/six months from the date of announcement of results.

L, lecture; T, Tutorial; P, Practical

THEORY COMPONENTS

The following topics/subtopics should be taught and assessed in order to attain the identified competency.

Topic and contents	Hours
<p>Topics include: origin, word building, abbreviations and symbols, terminology related to the human anatomy, reading medical orders and reports, and terminology specific to the student's field of study. Spelling is critical and will be counted when grading tests. Topics to be covered under the subject are as follows:</p> <ol style="list-style-type: none"> 1. Derivation of medical terms. 2. Define word roots, prefixes, and suffixes. 3. Conventions for combined morphemes and the formation of plurals. 4. Basic medical terms. 5. Form medical terms utilizing roots, suffixes, prefixes, and combining roots. 6. Interpret basic medical abbreviations/symbols. 7. Utilize diagnostic, surgical, and procedural terms and abbreviations related to the integumentary system, musculoskeletal system, respiratory system, cardiovascular system, nervous system, and endocrine system. 8. Interpret medical orders/reports. 9. Data entry and management on electronic health record system. 	18

Subject: Basic Computers and Information Science**Subject Code: BMRIT - 006****RATIONALE**

The students will be able to appreciate the role of computer technology. The course has focus on computer organization, computer operating system and software, and MS windows, Word processing, Excel data worksheet and PowerPoint presentation.

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme
L	T	P	C	
1	--	--	1	Examination Scheme Institute level exam only: The Institute level examination will be held before the commencement of the University examinations. A Pass in the subject with a minimum of 50 marks (50% of the total 100 marks) is compulsory in order to be eligible for the award of degree. These marks will not be considered for the award of class. Supplementary examination shall be conducted by the Institute for the benefit of unsuccessful candidates. Supplementary examinations will be conducted within six weeks/six months from the date of announcement of results.

L, lecture; T, Tutorial; P, Practical

THEORY COMPONENTS

The following topics/subtopics should be taught and assessed in order to attain the identified competency.

Topic and contents	Hours
Topics to be covered under the subject are as follows: <ol style="list-style-type: none"> 1. Introduction to computer: Introduction, characteristics of computer, block diagram of computer, generations of computer, computer languages. 2. Input output devices: Input devices (keyboard, point and draw devices, data scanning devices, digitizer, electronic card reader, voice recognition devices, vision-input devices), output devices (monitors, pointers, plotters, screen image projector, voice response systems). 3. Processor and memory: The Central Processing Unit (CPU), main memory. 4. Storage Devices: Sequential and direct access devices, magnetic tape, magnetic disk, optical disk, mass storage devices. 5. Introduction of windows: History, features, desktop, taskbar, icons on the desktop, operation with folder, creating shortcuts, operation with windows (opening, closing, moving, resizing, minimizing and maximizing, etc.). 6. Introduction to MS-Word: introduction, components of a word window, creating, opening and inserting files, editing a document file, page setting and formatting the text, saving the document, spell checking, printing the document file, creating and editing of table, mail merge. 	18

Subject: Medical law and ethics

Subject Code: BMRIT – 007

RATIONALE

Legal and ethical considerations are firmly believed to be an integral part of medical practice in planning patient care. Advances in medical sciences, growing sophistication of the modern society's legal framework, increasing awareness of human rights and changing moral principles of the community at large, now result in frequent occurrences of healthcare professionals being caught in dilemmas over aspects arising from daily practice.

Medical ethics has developed into a well based discipline which acts as a "bridge" between theoretical bioethics and the bedside. The goal is "to improve the quality of patient care by identifying, analyzing, and attempting to resolve the ethical problems that arise in practice". Doctors are bound by, not just moral obligations, but also by laws and official regulations that form the legal framework to regulate medical practice. Hence, it is now a universal consensus that legal and ethical considerations are inherent and inseparable parts of good medical practice across the whole spectrum.

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme
L	T	P	C	
1	--	--	1	Institute level exam only: The Institute level examination will be held before the commencement of the University examinations. A Pass in the subject with a minimum of 50 marks (50% of the total 100 marks) is compulsory in order to be eligible for the award of degree. These marks will not be considered for the award of class. Supplementary examination shall be conducted by the Institute for the benefit of unsuccessful candidates. Supplementary examinations will be conducted within six weeks/six months from the date of announcement of results.

L, lecture; T, Tutorial; P, Practical

THEORY COMPONENTS

The following topics/subtopics should be taught and assessed in order to attain the identified competency.

Topic and contents	Hours
<p>The important and relevant topics that need to focus on are as follows:</p> <ol style="list-style-type: none"> 1. Medical ethics - Definition - Goal - Scope 2. Introduction to Code of conduct 3. Basic principles of medical ethics – Confidentiality 4. Malpractice and negligence - Rational and irrational drug therapy 5. Autonomy and informed consent - Right of patients 6. Care of the terminally ill- Euthanasia 7. Organ transplantation 	18

Subject: Professionalism and Values**Subject Code: BMRIT – 008****RATIONALE**

The module on professionalism will deliver the concept of what it means to be a professional and how a specialized profession is different from a usual vocation. It also explains how relevant is professionalism in terms of healthcare system and how it affects the overall patient environment.

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme
L	T	P	C	
1	--	--	1	Institute level exam only: The Institute level examination will be held before the commencement of the University examinations. A Pass in the subject with a minimum of 50 marks (50% of the total 100 marks) is compulsory in order to be eligible for the award of degree. These marks will not be considered for the award of class. Supplementary examination shall be conducted by the Institute for the benefit of unsuccessful candidates. Supplementary examinations will be conducted within six weeks/six months from the date of announcement of results.

L, lecture; T, Tutorial; P, Practical

THEORY COMPONENTS

The following topics/subtopics should be taught and assessed in order to attain the identified competency.

Topic and contents	Hours
<ol style="list-style-type: none"> 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 	18

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Subject: Principals of Management

Subject Code: BMRIT – 009

RATIONALE

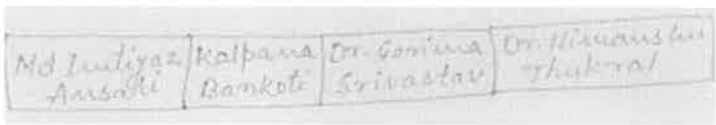

The course is intended to provide a knowledge about the basic principles of Management.

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme
L	T	P	C	Institute level exam only:
1	--	--	1	The Institute level examination will be held before the commencement of the University examinations. A Pass in the subject with a minimum of 50 marks (50% of the total 100 marks) is compulsory in order to be eligible for the award of degree. These marks will not be considered for the award of class. Supplementary examination shall be conducted by the Institute for the benefit of unsuccessful candidates. Supplementary examinations will be conducted within six weeks/six months from the date of announcement of results.

L, lecture; T, Tutorial; P, Practical

THEORY COMPONENTS

The following topics/subtopics should be taught and assessed in order to attain the identified competency.

Topic and contents	Hours
1. Introduction to management 2. Strategic Management 3. Foundations of Planning 4. Planning Tools and Techniques 5. Decision Making, conflict and stress management 6. Managing Change and Innovation 7. Understanding Groups and Teams 8. Leadership 9. Time Management 10. Cost and efficiency	18
 	

Subject: English and Communication skills

Subject Code: BMRIT - 010

RATIONALE


Patients need to feel safe enough to communicate honestly and openly with their care providers to receive effective treatments. Providers need to convey treatment plans and health education clearly, accessibly, and empathetically so that patients can receive optimal care.

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme
L	T	P	C	
1	--	--	1	Institute level exam only: The Institute level examination will be held before the commencement of the University examinations. A Pass in the subject with a minimum of 50 marks (50% of the total 100 marks) is compulsory in order to be eligible for the award of degree. These marks will not be considered for the award of class. Supplementary examination shall be conducted by the Institute for the benefit of unsuccessful candidates. Supplementary examinations will be conducted within six weeks/six months from the date of announcement of results.

L, lecture; T, Tutorial; P, Practical

THEORY COMPONENTS

The following topics/subtopics should be taught and assessed in order to attain the identified competency.

Topic and contents	Hours
<p>Language-Basic</p> <p>Content: Review of grammar, Remedial study of grammar, building vocabulary Introduction</p> <p>Parts of speech</p> <p>Exercise on use of grammar Tense, Number, Gender</p> <p>Assessment methods: Objective type, Fill in the blanks.</p> <p>Content: Read and comprehend prescribed course books Reading, Summarizing, Comprehension</p> 	18

BMRIT Radiology Clinical Education – part I (studentship)

Students will gain additional skills in clinical procedures, interaction with patients and professional personnel. Students apply knowledge from previous clinical learning experience under the supervision of a senior technologist. Students are tested on intermediate clinical radio diagnosis skills.

Studentship or observership must include:

- A minimum of 14 hours per week is considered as studentship in every semester.
- Provide simulation and skill labs for practicing skills specific to the program in the initial years of observership/studentship.
- Every semester must have seminars/workshops on new developments/ technologies. Check annexure for marking criteria.
- If the clinical facility is not within the same campus, transportation should be provided to the students and interns.
- All practical skills must be supervised and recorded in a Logbook and skills to be evaluated after the completion of the internship.

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Subject: Basics of Microbiology

Subject Code: BMRIT - 011

RATIONALE

Basics of Microbiology helps students to gain information about structure, metabolism reproduction, function and diseases caused by bacteria, viruses, bacterial viruses, animal viruses, archaea, mycoplasma and Phytoplasma. It also makes students aware of the nature and other important aspects of the microorganisms.

COURSE OUTCOMES

At the end of the course students will be able to...

CO001: Describe the structure, classification, morphology and growth of bacteria

CO002: Describe the methods sterilization and disinfection and its applications

CO003: Explain the concepts of immunity, hypersensitivity and immunization

CO004: Describe Nosocomial infections and methods for prevention of Hospital acquired infections

CO005: Describe the management of biomedical waste

CO006: List the common fungi and viruses and explain their importance

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme				
				Theory Marks		Practical Marks		Total Marks
L	T	P	C	CIE	ESE	CIE	ESE	
2	--	--	2	70	30	--	--	100

CIE, Continuous Internal Evaluation; ESE, End Semester Evaluation; L, lecture; T, Tutorial; P, Practical

THEORY COMPONENTS

The following topics/subtopics should be taught and assessed in order to attain the identified competency.

Unit	Topic and contents	Hours
I	Morphology of Bacteria: (Structure, size, shape, arrangement cell wall, flagella, spore, capsule, fimbria) Physiology of Bacteria: (Bacterial growth curve, Temp, O ₂ , Co ₂ , micro and macro nutrient growth requirements) Culture Media	9


End Semester Evaluation (ESE)**Written Paper**

Type of question	No. of questions	Marks per question	Total
Essay Question (EQ)	3 (to answer 2)	10	20
Short Essay Question (SEQ)	9 (to answer 7)	5	35
Short Answer Question (SAQ)	7 (to answer 5)	3	15
Total marks			70
Duration (minutes)			150

Question Paper Blueprint

Unit	Marks ($\pm 5\%$)
Unit I	26
Unit II	20
Unit III	13
Unit IV	22
Unit V	15
Total Marks (including optional questions)	96

SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication
1	Text book of Microbiology	Ananth Narayana & Panikkar	University Press
2	Text book of Microbiology	Baveja	Arya Publications
3	Text book of Microbiology	Sathish Gupte	JPB
4	Textbook of Microbiology 	Dr Arora	CBS Publishers & Distributors Pvt. Ltd

THEORY COMPONENTS


The following topics/subtopics should be taught and assessed in order to attain the identified competency.

Unit	Topic and contents	Hours
I	<p>Nutrition</p> <p>Calorific value</p> <p>Nitrogen Balance</p> <p>Respiratory quotient</p> <p>BMR</p> <p>Nutritional importance of carbohydrate, lipids, proteins, vitamins and minerals</p> <p>Emphasis on parenteral nutrition</p>	9
II	<p>Acid–Base Balance</p> <p>Henderson Hassel Bach equation</p> <p>Buffers of the body fluids</p> <p>Ph regulation</p> <p>Disturbance in acid base balance</p> <p>Anion gap</p> <p>Basic principles & estimation of blood gases and ph.</p> <p>Water & Electrolyte balance</p> <p>Over view of water and electrolyte balance</p> <p>Basic principles in estimation of Electrolyte</p> <p>Normal values and interpretation</p>	9
III	<p>Clinical chemistry</p> <p>Brief over view of normal values and interpretation of results</p> <p>Renal function tests</p> <p>Liver function tests</p> <p>Tumor markers</p> <p>Cardiac markers</p> <p>Diagnostic Enzymology</p> <p>Lipid profile</p>	9

Question Paper Blueprint

Unit		Marks ($\pm 5\%$)
1.	Introduction to Clinical Biochemistry, Chemicals & Reagents, Preparation of solution, Specimen collection and handling	25
2.	Nutrition	20
3.	Acid–Base Balance; Water & Electrolyte balance	22
4.	Clinical chemistry; Brief over view of normal values and interpretation of results	14
5.	Radioisotopes: Definition, Application & Hazards	15
6.		
Total Marks (including optional questions)		96

SUGGESTED LEARNING RESOURCES

S.No.	Title of Book	Author	Publication
1	Text Book of biochemistry for dental students	Vasudevan, Sreekumari, Kannan Vaidyanathan	Jaypee Brothers
2	Biochemistry for Physiotherapy and allied health sciences students.	Nandini M, Beena V Shetty, Vinitha Ramanath Rai	Jaypee Brothers Medical Publisher (India)
3	Clinical chemistry	Varley	CBS Publishers & Distributors
4	Textbook of biochemistry for paramedical students 	P Ramamoorthy	Jaypee Brothers Medical Publishers

THEORY COMPONENTS

The following topics/subtopics should be taught and assessed in order to attain the identified competency.

Unit	Topic and contents	Hours
I	<p>X-ray tube: historical aspects, construction of X-ray tubes, requirements for X-ray production (Electron source, target and anode material), tube voltage, current, space charge, early X-ray tubes (Coolidge tubes, tube envelop and housing) cathode assembly, X-ray production efficiency, advances in X-ray tubes, anode angulation and rotating tubes-line focus principle-space charge effect, tube cooling-Modern X-ray tubes-stationary anode, rotating anode, grid controlled X-ray tubes, heel effect, off focus radiation, tube insert and housing-Tube rating-Quality and intensity of x-rays-factors influencing them.</p> <p>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;</p>	10
II	<p>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.</p> <p>Grid controlled and high-speed tubes, focal spot size, speed of anode rotation, target angle, inherent filtration, radiation leakage and scattered radiation). Interlocking and X-ray tube overload protection.</p> <p>Heat dissipation methods, tube rating, heat units, operating conditions and maintenance and Q.A procedures.</p>	10
III	<p>Filament current and voltage, X-ray circuits (primary circuit, auto transformer), types of exposure switch and timers, principle of automatic exposure control (AEC) and practical operation, filament circuit, high voltage circuits, half wave, full wave rectification, three phase circuits. Types of generators, 3 phase, 6 and 12 pulse circuits-high frequency generators-falling load generators, Capacitors discharge and grid control systems.</p> <p>X-ray generator circuits: Vacuum tube diodes-semi-conductor diodes-transistor-Rectification-half and full wave-self rectification-X-ray generator; filament circuit-kilo Voltage circuit-single phase generator-three phase generator-constant potential generator-Fuses, switches and interlocks-Exposure switching and timers-HT cables-earthing.</p>	10
IV	<p>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;</p>	10

SUGGESTED PRACTICALS/DEMONSTRATION

Sr. No		Hours
1.	X-ray tube; Production of x-rays	5
2.	Rotating anode x - ray tube; Grid controlled and high-speed tubes; Heat dissipation methods	4
3.	Filament current and voltage; X-ray generator circuits	5
4.	High tension circuits; Interlocking circuits; Relays	5
5.	Meters and exposure timers	5
6.	Control of scattered radiation: Beam limiting devices	4
7.	Fluoroscopy	4
8.	Care and Maintenance of X-ray equipment	4
	Total	36

Evaluation System**Continuous Internal Evaluation (CIE)**

Sl. No.	Component	Marks	Weightage	IA marks
1.	Sessional test(s)			
	Two Written tests <ul style="list-style-type: none"> • Same pattern as Summative test • Average of two to be considered • Absence without prior permission to be marked as 0 	50		
	Total	50	0.3	15
2.	Continuous assessment			
	Seminars/Case presentations/ Logbook/ Case records/Record book/assignment			
	Total	50	0.3	15
	Total CIE marks			30

Subject: Clinical Radiography Positioning (Part I)**Subject Code: BMRIT - 014****RATIONALE**

Clinical Radiography Positioning Part- 1 provides the students with knowledge of x-ray imaging, positioning and all the care that should be taken.

COURSE OUTCOMES

At the end of the course students will be able to...

CO1: Understand the basic patient positioning during radiographic investigation.

CO2: Apply special positioning skills for different pathological and physical conditions.

CO3: Application of equipments while working in radiology departments.

CO4: Choose proper position during radiography.

CO5: Explain relative positions of x-ray tube and patient relevant exposure factors during radiography.

CO6: Explain the use of accessories.

CO7: Explain the anatomic and physiological basis of the procedure to be undertaken.

CO8: Explain the radiographic appearances of both normal and common abnormal conditions.

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme				
L	T	P		Theory Marks		Practical Marks		Total Marks
L	T	P	C	CIE	ESE	CIE	ESE	
4	1	6	8	30	70	30	70	

CIE, Continuous Internal Evaluation; ESE, End Semester Evaluation; L, lecture; T, Tutorial; P, Practical

TUTORIAL ASSIGNMENTS

Tutorials should be planned to enhance learning. The faculty shall decide suitable tutorial assignments of minimum one hour per unit based on the curriculum.

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VI	<p>Skull: Routine projections for cranium and facial bones; Supplementary projections for trauma, Towne's method, Sellaturcica, Optic foramina, Jugular foramina, Temporal bones, Mastoids, Petrous bone, Zygomatic arches, Orbits, Maxillae, Nasal bones, Mandible, Temporomandibular joints. Nasal Sinuses: Techniques for Frontal, Maxillary, Ethmoidal and Sphenoid Sinuses, erect and horizontal projections for fluid levels.</p>	12
VII	<p>Pelvic girdle and hip region: Routine projections for the whole pelvis, Sacro-Ileac joints, hip joint and Neck of Femur. Supplementary projections for the greater and lesser trochanters of Femur. Frog leg projection, Ischium, Symphysis Pubis, Ileum, Acetabulum and Congenital Dislocation of Hip, Arthrodesis. Skeletal survey: Skeletal survey for metabolic bone disease, metastases, hormonal disorder, renal disorders.</p>	10
Total		72

No. of Exams.	Mark Obtained	In Percentage	Signature of Examiner
17/1	100	60	[Signature]

End Semester Evaluation (ESE)

There shall be practical examination for 70 marks in the subject.

Distribution of marks for ESE practical exams:

ESE		CIE		Grand total
Practical	Viva		Sub Total	
50	20	30	100	100

Question Paper Blueprint

Unit	TOPICS	Marks 5%)	(±)
1.	Principles of Radiography	13	
2.	Upper limb	15	
3.	Lower limb	13	
4.	Shoulder Girdle and Thorax	13	
5.	Vertebral Column	15	
6.	Skull	13	
7.	Pelvic girdle and hip region, Skeletal survey	14	
Total Marks (including optional questions)		96	



Third Semester

Md. Imtiaz Ansari	Kalpna Bankoti	Dr. Geeta Srivastava	Dr. Himanshu Thakral
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THEORY COMPONENTS

The following topics/subtopics should be taught and assessed in order to attain the identified competency.

Unit	Topic and contents	Hours	Marks
I	<p>Introduction to Pathology, Cell membrane, Cytoplasm, contents and nucleus Various injuries – Cell changes – Reversible changes, fatty liver, hydropic changes and Irreversible changes</p> <p>Irreversible changes – Necrosis. Types with examples. Apoptosis Pigments – Classification. Bilirubin, melanin, pathological calcification</p> <p>Inflammation -- Definition, classification, signs, vascular & cellular events in acute inflammation</p> <p>Repair and wound healing, fracture healing, complications, factors influencing healing</p> <p>Infectious diseases – Tuberculosis, leprosy, fungal diseases, malaria</p>	7	10
II	<p>Oedema – Definition, classification, causes, pathogenesis. Pulmonary oedema, cardiac oedema, Renal oedema, Lymphedema</p> <p>Thrombosis – Definition, classification, pathogenesis, venous and arterial thrombosis, fate of thrombus</p> <p>Embolism – Definition, classification and clinical manifestations – Infarction, gangrene</p> <p>Cellular adaptations and Growth disorders: Atrophy, hypertrophy, hyperplasia, metaplasia, dysplasia and neoplasia</p> <p>Neoplasia (Tumors) – Definition, nomenclature, differences between benign and malignant tumors metastasis</p> <p>Causes (carcinogens), clinical features and lab diagnosis of cancers</p> <p>Genetics – Genetic diseases, cause, Common cytogenic diseases – Klinefelter, Downs and Turners syndrome.</p> <p>Complete urine examination – physical, chemical, microscopy of sediment Liver function tests, Renal function tests</p> <p>Cytology, FNAC, Surgical pathology, biopsy, resected specimen preservation, fixation and filling of request forms</p>	8	15

V	Respiratory diseases – Chronic obstructive pulmonary airway diseases – causes, pathology and complications of each (asthma, chronic bronchitis, emphysema, Bronchiectasis in brief). Pneumonia – classification, clinical features and morphology Pulmonary tuberculosis – classification/ types, primary, complex, miliary TB and cavitatory TB, complications Pleural effusion – definition, causes, clinical features and diagnosis Renal system; Glomerulonephritis, nephritic and nephrotic syndrome. Tubulointerstitial diseases, Renal failure – Acute and chronic Pyelonephritis – Types, causes, organ changes and complications. Renal stones – Causes, pathogenesis, clinical features. Hydronephrosis – causes, clinical features and diagnosis	7	15
Total		36	70


SUGGESTED PRACTICALS/DEMONSTRATION

Sr. No		Hours
	<ul style="list-style-type: none"> • Fatty liver – Gross & Microscopy • T.B. Lymphadenitis – Gross & Microscopy • Acute Appendicitis – Gross & Microscopy • Granulation tissue – Microscopy • Mechanism of thrombosis, Sites & complications and clinical features (effects) • Atrophy & Hypertrophy (Heart). • Benign tumors - Squamous papilloma – Gross & Microscopy, Adenoma Colon <ul style="list-style-type: none"> ○ Gross & Microscopy, Leiomyoma uterus – Gross & Microscopy; • Malignant tumors - Squamous cell carcinoma – Gross & Microscopy, Adenocarcinoma colon – Gross & Microscopy, Malignant melanoma skin – Gross & Microscopy, Osteosarcoma bone – Gross & Microscopy • Metastasis – Lung, liver, lymph nodes (specimens) • Blood collections – Containers, Anticoagulants Hb%, PCV, ESR, Peripheral smear and Bone marrow aspiration • Cytology – Body fluids, FNAC. • Histopathology – Specimens, biopsies, fixatives. Request form writing. 	6

Question Paper Blueprint

Unit	Marks ($\pm 5\%$)
Unit I	16
Unit II	20
Unit III	20
Unit IV	20
Unit V	20
Total Marks (including optional questions)	96

SUGGESTED LEARNING RESOURCES

S.No.	Title of Book	Author	Publication
1	Textbook of Pathology with Pathology	Harsh Mohan	Jaypee Brothers Medical Publishers (P) Ltd
2	Pathology Basis of Disease	Robbins and Cotran	Saunders Elsevier
3	Text book on Pathology for DMLT & Paramedical Courses	Dr. I Clement	Emmess medical publishers
4	Text book of Pathology & Microbiology for Paramedical Students 	Aruna Singh	Notion Press

THEORY COMPONENTS

The following topics/subtopics should be taught and assessed in order to attain the identified competency.

Unit	Topic and contents	Hours	Marks
I	<p>Dental Radiography</p> <p>Technique for intra oral full mouth. - Occlusal projections. - Extra oral projections including orthopantomography. - Supplementary techniques.</p> <p>Upper respiratory system</p> <p>Technique for postnasal airways, larynx, trachea, thoracic inlet, Valsalva maneuver. - Phonation.</p>	5	10
II	<p>Lung and Mediastinum: Supplementary projections: Antero-posterior, obliques, lordotic, apical projection, use of penetrated postero-anterior projection. - Expiration technique. - Technique for pleural fluid levels and adhesions.</p> <p>Abdominal viscera-</p> <p>Technique for plain film examination. - Projection for acute abdomen patients. - Technique to demonstrate: Foreign bodies, Imperforate anus.</p>	6	10
III	<p>Radiography using mobile X-ray equipment- Radiography in the ward:</p> <p>Radiography in the specialized unit, such as: Intensive care unit, Coronary care, Neonatal unit Radiography in the operating theatre.</p> <p>Mammography: Basic views, special views, wire localization.</p> <p>Localization of foreign bodies. Various techniques</p>	5	10
IV	<p>Ward /mobile radiography –</p> <p>electrical supply, radiation protection, equipment and instructions to be followed for portable/ward radiography.</p> <p>Operation theatre techniques:</p> <p>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.</p> <p>Trauma radiography/Emergency radiography</p>	5	10
V	<p>Neonatal and Pediatric Radiography,</p> <p>Forensic Radiography Microradiography:</p> <p>General principles, Requirement, Equipment, Technique.</p>	5	10

Evaluation System
Continuous Internal Evaluation (CIE)

Sl. No.	Component	Marks	Weightage	IA marks
1.	Sessional test(s)			
	Two Written tests Same pattern as Summative test Average of two to be considered Absence without prior permission to be marked as 0	50		
	Total	50	0.3	15
2.	Continuous assessment			
	Seminars/Case presentations/ Logbook/ Case records/Record book/assignment			
	Total	50	0.3	15
	Total CIE marks			30

End Semester Evaluation (ESE)

Written Paper

Type of question	No. of questions	Marks per question	Total
Long Essay	3 (to answer 2)	10	20
Short Essay	8 (to answer 6)	5	30
Short Answer	12 (to answer 10)	3	30
			80
Duration (minutes)			150

Mr. Anil Kumar A. S. S. S.	Mr. Anil Kumar B. S. S. S.	Mr. Anil Kumar C. S. S. S.	Mr. Anil Kumar D. S. S. S.

SUGGESTED LEARNING RESOURCES

S.No.	Title of Book	Author	Publication
1	Radiological positioning	Merils	Mosby
2	A guide to radiological positioning	Clarks	CBS publishers and distributors pvt. Ltd
3	Radiology Of Positioning And Applied Anatomy for Students and Practitioners	Garages	Jaypee Brothers Medical Publishers
4	Bontrager's Textbook of Radiographic Positioning and Related Anatomy	John Lampignano), Leslie E. Kendrick	Mosby
5	A Concise Guide on Basic Radiographic Physics Darkroom Procedures, Radiographic Positioning & Techniques	Lalit Agarwal	JBD Publications

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THEORY COMPONENTS

The following topics/subtopics should be taught and assessed in order to attain the identified competency.

Unit	Topic and contents	Hours	Marks
I	<p>Photographic Principles:</p> <p>Radiographic film- construction and types; Photographic effect and latent image formation; Film density and log relative exposure; Characteristic curve – its formation and features; Spectral response; Film faults and Artifacts</p> <p>Intensifying Screen: Luminescence-fluorescence and phosphorescence; Construction and types of Intensifying Screens; Intensification Factor, quantum detection and conversion efficiency; Film screen matching; Resolving power of Intensifying Screens; Speed of intensifying screen; Screen film contact tests; Advantages and limitations of Intensifying Screens</p> <p>X-ray Cassette: Construction of X-ray cassettes; Types of cassettes; Mounting Intensifying Screens on cassettes; Care and maintenance of cassettes</p>	9	20
II	<p>Dark Room – Planning & Construction:</p> <p>Planning for a small & large Hospital; Location of Dark Room; Construction of Dark Room; Ventilation; Wall Protection; Entrance to Dark Room - Single Door, Double Door, Labyrinth</p> <p>Dark Room Accessories: Dry bench; Hopper, Drawer, Cupboard; Loading and unloading cassettes; Hangers, types of hangers and storage of hangers; Wet bench; Cleanliness, control of dust, dark room sinks; Hatches; Drier; Safe Lights-types and uses, factors affecting safelight performance, safelight Tests; Viewing room, Film dispensing</p>	7	15
III	<p>Film Processing: Photochemistry;</p> <p>Developer; Rinsing; Fixer; Washing and drying;</p> <p>Preparation of processing solutions; Manual processing apparatus; Effect of temperature in processing; Rapid processing</p> <p>Automatic processor: Principle of working and features, thermal regulation and replenishment system; Care and maintenance of automatic processor; Advantages and limitations of automatic processor</p>	7	15

Evaluation System

Continuous Internal Evaluation (CIE)

Sl. No.	Component	Marks	Weightage	IA marks
1.	Sessional test(s)			
	Two Written tests Same pattern as Summative test Average of two to be considered Absence without prior permission to be marked as 0	50		
	Total	50	0.3	15
2.	Continuous assessment			
	Seminars/Case presentations/ Logbook/ Case records/Record book/assignment			
	Total	50	0.3	15
	Total CIE marks			30

End Semester Evaluation (ESE)

Written Paper

Type of question	No. of questions	Marks per question	Total
Long Essay	3 (to answer 2)	10	20
Short Essay	8 (to answer 6)	5	30
Short Answer	12 (to answer 10)	3	30
			80
Duration (minutes)			150

Question Paper Blueprint

Unit	Marks ($\pm 5\%$)
1. Radiographic film; Intensifying Screens; X-ray Cassette	25
2. Dark Room – Planning & Construction	20
3. Film Processing; Photochemistry;	20
4. Day Light Film handling; Xeroradiography, Stereoscopy	10
5. The emergent beam related to densities on film contrast – objective and subjective Radiation contrast, film contrast and Radiographic contrast- Density, Sharpness, Unsharpness; Factors affecting resolution; Reproduction of Radiographs	21
Total Marks (including optional questions)	96

Subject: Contrast and Special Radiological Procedures**Subject Code: BMRIT - 018****RATIONALE**

Contrast & Special Radiological Procedures are diagnostic procedures usually performed by giving contrast through oral or intravenous to diagnose the disease. These imaging procedures are done under the guided of fluoroscopy or c-ram equipment.

COURSE OUTCOMES

At the end of the course students will be able to...

CO1: Prepare management and positioning of patients while performing radiological procedures.

CO2: Correlate of indications, contraindications, contrast media, radiation dose, exposure timing and radiation safety measures for different radiological procedures.

CO3: Understand the patient preparations needed before any radiological examination.

CO4: Generalize knowledge of post procedural care.

CO5: Students will be able position the patients for radiological procedures.

CO6: Knowledge of image quality in radiological images.

CO7: Management of patients in radiology department for various procedures.

CO8: Ability to handle emergency situations in radiology department.

CO9: Precautions and care required in interventional suits.

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme				
L	T	P		Theory Marks		Practical Marks		Total Marks
				CIE	ESE	CIE	ESE	
2	1	6	6	30	70	30	70	200

CIE, Continuous Internal Evaluation; ESE, End Semester Evaluation; L, lecture; T, Tutorial; P, Practical

TUTORIAL ASSIGNMENTS

Tutorials should be planned to enhance learning. The faculty shall decide suitable assignments minimum one per unit based on the curriculum.

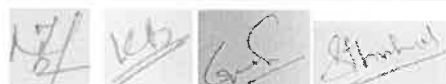


SUGGESTED PRACTICALS/DEMONSTRATION

Sr. No		Hours
1.	General approach to special radiographic procedures, responsibility of radiology technologist during radiological procedures Contrast media and their adverse reactions to contrast media and patient management	25
2.	Procedures for gastrointestinal tract including barium studies Procedures for biliary tract	29
3.	Procedures for urinary system and reproductive system	29
4.	Procedures for central nervous system and respiratory system	25
	Total	108

Evaluation System**Continuous Internal Evaluation (CIE)**

Sl. No.	Component	Marks	Weightage	IA marks
1.	Sessional test(s)			
	Two Written tests Same pattern as Summative test Average of two to be considered Absence without prior permission to be marked as 0	50		
	Total	50	0.3	15
2.	Continuous assessment			
	Seminars/Case presentations/ Logbook/ Case records/Record book/assignment			
	Total	50	0.3	15
	Total CIE marks			30

Prof. Anil Kumar / Kaishava / Dr. Venkatesh / Dr. Srinivasan
 Assistant / Assistant / Assistant / Assistant


SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication
1	Radiographic Imaging (CBS)I.C.R.P.	Bhushan and Lakhra	Arya Publications
2	A guide to radiological procedures	Chapman	Elsevier

BMRIT Radiology Clinical Education – Part III (studentship)

Students will gain additional skills in clinical procedures, interaction with patients and professional personnel. Students apply knowledge from previous clinical learning experience under the supervision of a senior technologist. Students are tested on intermediate clinical radio diagnosis skills.

Studentship or observership must include:

- A minimum of 14 hours per week is considered as studentship in every semester.
- Provide simulation and skill labs for practicing skills specific to the program in the initial years of observership/studentship.
- Every semester must have seminars/workshops on new developments/ technologies. Check annexure for marking criteria.
- If the clinical facility is not within the same campus, transportation should be provided to the students and interns.
- All practical skills must be supervised and recorded in a Logbook and skills to be evaluated after the completion of the internship.

Md Intiyaz Ansari	Kalpama Bamkoti	Dr. Gornima Srivastav	Dr. Himanshu Thakral
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Subject: Cross Sectional Anatomy

Subject Code: BMRIT - 019

RATIONALE

Cross sectional anatomy provides the students with Skills that are important to help the technologist in MRI and CT to identify the anatomy being imaged and to communicate effectively with the radiologist and physicians.

COURSE OUTCOMES

At the end of the course students will be able to...

CO1: Identify cross-sectional anatomy in the sagittal, coronal and axial planes on CT and MR images.

CO2: Describe anatomical structural relationships.

CO3: Recognize normal anatomy and build a personal resource system for future study.

CO4: Locate and identify pertinent cerebral, upper thorax, mid-thorax, and abdominal anatomy.

CO5: On CT and MR images, identify anatomical structures of the body and of the head.

CO6: Distinguish between arterial and venous anatomy of the entire body's vascular system.



CO7: Classify the various sections of anatomical regions and their associated parts.

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme				
L	T	P		Theory Marks		Practical Marks		Total Marks
				CIE	ESE	CIE	ESE	
2	--	6	5	--	--	30	70	100

CIE, Continuous Internal Evaluation; ESE, End Semester Evaluation; L, lecture; T, Tutorial; P, Practical

THEORY COMPONENTS

The following topics/subtopics should be taught and assessed in order to attain the identified competency.

Unit	Topic and contents	Hours	Marks
I	<p>Introduction to Sectional Anatomy & Terminology- Sectional planes, Anatomical relationships/terminology</p> <p>Anatomy of the upper thorax-Surface anatomy relationships, Bony structures and muscles, Blood vessels.</p>  	12	--

SUGGESTED PRACTICALS/DEMONSTRATION

Sr. No		Hours
1.	<p>Introduction to Sectional Anatomy & Terminology- Sectional planes, Anatomical relationships/terminology</p> <p>Anatomy of the upper thorax-Surface anatomy relationships, Bony structures and muscles, Blood vessels.</p> <p>Divisions of the mid-thorax, heart and great vessels-Lungs, heart and great vessels, Esophagus</p>	36
2.	<p>CT/MRI Images of the Thorax - Normal and abnormal imaging</p> <p>Anatomy of the Abdomen- Major organs and their accessories, Abdominal blood vessels</p> <p>CT/MR Images of Abdomen – Normal and pathologic anatomy of the Pelvis- Bony structures and associated muscles, Digestive and urinary systems</p> <p>Reproductive Organs - Normal and abnormal imaging</p>	36
3.	<p>CT/MR Images of the Male/Female Pelvis- Normal and pathologic</p> <p>Neuro Anatomy-Scan planes</p> <p>Brain –Cerebral hemispheres, Sinuses, Ventricles, Brainstem and associated parts, Arterial/venous systems, Basal ganglia, Cranial nerves</p> <p>Spine- Vertebra and disc, Spinal cord and meninges</p> <p>Neck-Arterial/venous systems, Muscles, Glands and pharynx</p>	36
	Total	108

Dr. Anurag Anand	Dr. Kalyani Borkar	Dr. Geetika Srinivasan	Dr. Manoj Kumar Thakral
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Subject: Modern Radiological Imaging Equipment and Physics**Subject Code: BMRIT – 020****RATIONALE**

Modern radiological Imaging Equipment and Physics provides the students' knowledge about the modern x-ray equipment and working principle. Modern imaging techniques – including X-rays, ultrasound, CT scans and MRI – can show structures inside your body in great detail. Radiologic Physics is the study of medical imaging components, technology, and parameters in an effort to produce optimal imaging results. The goal with studying radiologic physics is to ensure you get clear images while ensuring the patient is safe from radiation.

COURSE OUTCOMES

At the end of the course students will be able to...

CO001: Describe the special radiological equipments

CO002: Describe the digital and computed radiography

CO003: Describe PACS, RIS and HIS

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme				Total Marks
L	T	P		Theory Marks		Practical Marks		
				CIE	ESE	ESE	CIE	
2	1	2	3	30	70	--	--	100

CIE, Continuous Internal Evaluation; ESE, End Semester Evaluation; L, lecture; T, Tutorial; P, Practical

TUTORIAL ASSIGNMENTS

Tutorials should be planned to enhance learning. The faculty shall decide suitable assignments minimum one per unit based on the curriculum.



Evaluation System**Continuous Internal Evaluation (CIE)**

Sl. No.	Component	Marks	Weightage	IA marks
1.	Sessional test(s)			
	Two Written tests Same pattern as Summative test Average of two to be considered Absence without prior permission to be marked as 0	50		
	Total	50	0.3	15
2.	Continuous assessment			
	Seminars/Case presentations/ Logbook/ Case records/Record book/assignment			
	Total	50	0.3	15
	Total CIE marks			30

End Semester Evaluation (ESE)**Written Paper**

Type of question	No. of questions	Marks per question	Total
Essay Question (EQ)	3 (to answer 2)	10	20
Short Essay Question (SEQ)	9 (to answer 7)	5	35
Short Answer Question (SAQ)	7 (to answer 5)	3	15
Total marks			70
Duration (minutes)			150

Question Paper Blueprint

Unit		Marks (±5%)
1.	Modern x-ray tube. Digital Mammography and Tomosynthesis, Stochastic radiography, Dual energy x-ray absorptiometry (DEXA) scan.	25
2.	Computed radiography: its principle, physics & equipment. Digital Radiography: its principle, physics & equipment. Flat panel digital fluoroscopy and radiography system, Direct and indirect digital radiography and fluoroscopy systems. Digital radiography and Computed radiography its advantages, disadvantages and applications. Digital Portable and mobile x-ray units.	25
3.	Modern dental equipments. Cone beam dental CT.	25
4.	Picture archiving and communication system (PACS), RIS and HIS.	21
	Total Marks (including optional questions)	96

Subject: Interventional Radiology Techniques**Subject Code: BMRIT -021****RATIONALE**

Interventional radiology (IR) helps student MRIT to gain about the basics diagnostics and interventional procedures and to learn procedures in modalities like digital radiography CT and MRI and nuclear medicine and to increase the level of understandings and knowledge required to meet current radiologic procedures and to understand the physical principles of radiography and basic radiography positioning to perform the procedures. it a medical specialty that performs various minimally-invasive procedures using medical imaging guidance, such as x-ray fluoroscopy, computed tomography, magnetic resonance imaging, or ultrasound. IR performs both diagnostic and therapeutic procedures through very small incisions or body orifices

COURSE OUTCOMES

At the end of the course students will be able to...

CO1: Know the basic principle and physics of interventional equipment.

CO2: Know the management and positioning of patients while performing interventional radiological procedure.

CO3: Have knowledge about the indications, contraindications, contrast media, radiation dose, exposure timing and radiation safety measures for the different interventional radiological procedure.

CO4: Understand the patient preparation needed before any interventional radiological procedures.

CO5: Have knowledge about the post procedural care and safety.

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme				Total Marks
L	T	P		Theory Marks		Practical Marks		
L	T	P	C	CIE	ESE	CIE	ESE	200
2	1	4	4	30	70	30	70	

CIE, Continuous Internal Evaluation; ESE, End Semester Evaluation; L, lecture; T, Tutorial; P, Practical

TUTORIAL ASSIGNMENTS

Tutorials should be planned to enhance learning. The faculty shall decide suitable assignments minimum one per unit based on the curriculum.



SUGGESTED PRACTICALS/DEMONSTRATION

Sr. No		Hours
1.	Basics of angiographic equipments	18
2.	Catheter and guide wires	18
3.	Arteriography and venography procedures	18
4.	Safety considerations in angiography room	18
	Total	72

Evaluation System**Continuous Internal Evaluation (CIE)**

Sl. No.	Component	Marks	Weightage	IA marks
1.	Sessional test(s)			
	Two Written tests Same pattern as Summative test Average of two to be considered Absence without prior permission to be marked as 0	50		
	Total	50	0.3	15
2.	Continuous assessment			
	Seminars/Case presentations/ Logbook/ Case records/Record book/assignment			
	Total	50	0.3	15
	Total CIE marks			30

End Semester Evaluation (ESE)**Written Paper**

Type of question	No. of questions	Marks per question	Total
Essay Question (EQ)	3 (to answer 2)	10	20
Short Essay Question (SEQ)	9 (to answer 7)	5	35
Short Answer Question (SAQ)	7 (to answer 5)	3	15
Total marks			70
Duration (minutes)			150

Subject: Patient Care in radiology

Subject Code: BMRIT - 022

RATIONALE

Patient management is based on team work, it is essential that the student should appreciate the technologist's role and that the importance of co-operation with wards and other departments. The students should be attached to wards or the accident and emergency department for a definite training period.

COURSE OUTCOMES

At the end of the course, students will be able to...

CO1: Understand the responsibility of the imaging technologist and other health care facility.

CO2: Understand the management and care of patient during different procedures and emergency situations.

CO3: Know about different patient transfer techniques and to restrain the uncooperative patients during radiological examination

CO4: Differentiate the types of consent forms

CO5: Know about infection control, infection source and isolation techniques

CO6: Describe sterilization techniques

CO7: Understand the radiation safety and protection

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme				
L	T	P		Theory Marks		Practical Marks		Total Marks
				CIE	ESE	CIE	ESE	
1	1	4	4	30	70	30	70	200

CIE, Continuous Internal Evaluation; ESE, End Semester Evaluation; L, lecture; T, Tutorial; P, Practical


TUTORIAL ASSIGNMENTS

Tutorials should be planned to enhance learning. The faculty shall decide suitable assignments minimum one per unit based on the curriculum.



VI	<p>Patient care in following investigations: GIT, Respiratory system, Cardiovascular system, CNS; Sterilization; Infection control</p> <p>Departmental procedures: Department staffing and organizations; 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-patient and follow-up clinics; stock taking and stock keeping.</p>	2	10
VII	<p>Drugs in the department and Storage: classification; labelling and checking, regulations regarding dangerous and other drugs; units of measurement, special drugs, anti-depressive, anti-hypertensive etc. crash cart.</p> <p>Medical ethics and records: Medico legal implication of MLC cases, Importance of consent, Consent in detail, Precaution while dealing with female patient, medical records</p>	3	10
Total		18	70

SUGGESTED PRACTICALS/DEMONSTRATION

Sr. No		Hours
1.	Introduction to Patient Care and Communication	10
2.	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.	11
3.	Care of the patient	10
4.	Nursing procedures in Radiology and first aid	11
5.	Infection and Principles of asepsis	10
6.	Patient care in following investigations: GIT, Respiratory system, Cardiovascular system, CNS; Sterilization; Infection control.	10
7.	Drugs in the department and Storage and medical ethics and records	10
Total		72
		

Question Paper Blueprint

Unit		Marks (\pm 5%)
1.	Introduction to Patient Care and Communication	10
2.	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.	14
3.	Care of the patient	10
4.	Nursing procedures in Radiology and first aid	14
5.	Infection and Principles of asepsis	14
6.	Patient care in following investigations: GIT, Respiratory system, Cardiovascular system, CNS; Sterilization; Infection control.	20
7.	Drugs in the department and Storage and medical ethics and records	14
	Total Marks (including optional questions)	96

SUGGESTED LEARNING RESOURCES

S.No.	Title of Book	Author	Publication
1	Patient care in radiography	Ruth Ann Ehrlich, Dawn M Coakes	Mosby
2	Concise Textbook on Hospital Management & Patient Care in Diagnostic Radiology	N.K. Kardam, <u>Lalit Agarwal</u>	JBD Publications
3	Patient care in radiography: with an introduction to medical imaging	Ruth Ann Ehrlich and Joan A. Daly	St. Louis, Mo.: Mosby Elsevier
4	Introduction To Radiologic and Imaging Sciences and Patient Care	<u>Adler A M</u>	<u>Elsevier</u>
5	Concise Text Book on Hospital Management & Patient Care in Diagnostic Radiology	Lalit Agarwal, Dr. N.K. Kardam	JBD Publications

Handwritten signatures and stamps of the authors and publishers mentioned in the suggested learning resources.

Fifth Semester

Md Imuliyaz Ansari	Kalpana Bamkoti	Dr. Gomina Srivastav	Dr. Himanshu Thakral
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TUTORIAL ASSIGNMENTS


Tutorials should be planned to enhance learning. The faculty shall decide suitable assignments minimum one per unit based on the curriculum.

THEORY COMPONENTS

The following topics/subtopics should be taught and assessed in order to attain the identified competency.

Unit	Topic and contents	Hours	Marks
I	Introduction and history, CT principle, CT generations, CT Instrumentation, CT detectors, Axial & Helical CT – Slip ring technology	15	20
II	Data acquisition, Image pre-processing/reconstruction techniques, Algorithms for image reconstruction, Image display, Image post-processing techniques, CT artifacts, Image quality	14	10
III	CT Protocols for different body parts & Dental scan, CT Protocols for Angiography & Perfusion, CT contrast media and administration, CT guided interventional procedures	14	15
IV	Multi-detector CT Isotropic imaging, Cardiac CT, Flash CT, Advanced CT scanners, Dual energy & Dual Source Scanners, CT-fluoroscopy	15	15
V	Safety consideration, Documentation in CT, Role of Medical Imaging technologist in CT scan procedures, Quality assurance in CT	14	10
Total		72	70

SUGGESTED PRACTICALS/DEMONSTRATION

Sr. No		Hours
1.	Introduction and history, CT principle, CT generations, CT Instrumentation, CT detectors, Axial & Helical CT – Slip ring technology	30
2.	Image post-processing techniques, CT artifacts 	20

Subject: Radiation Safety in Diagnostic Radiology**Subject Code: BMRIT - 024****RATIONALE**

Radiation protection aims to reduce unnecessary radiation exposure with a goal to minimize the harmful effects of ionizing radiation. In the medical field, ionizing radiation has become an inescapable tool used for the diagnosis and treatment of a variety of medical conditions .to study radiation physics relevant to radiation protection to gain information on radiation types and does receive to study the molecular and cellular effects of radiations and to know the radiation quantities units dose limits and regulatory bodies to know about equipment design for radiation protection and to implement patient and personnel radiation protection practices for radiological procedures

COURSE OUTCOMES

At the end of the course, students will be able to learn:

CO1: Aim and need of radiation protection

CO2: Introduction to Radiation units and quantities

CO3: Understanding of various Radiation protection regulations and the dose limits

CO4: Radiation protection to patients, occupational workers and general public in Diagnostic Radiology

CO5: Layout of Radiology department

CO6: Use of protective devices and awareness of radiation with radiation signages

CO7: Dose reduction measures with technical protective considerations during radiology

CO8: Different radiation measuring devices

CO9: Effects of radiation on biological tissue

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme				
				Theory Marks		Practical Marks		Total Marks
L	T	P	C	CIE	ESE	CIE	ESE	
2	1	4	5	30	70	30	70	200

CIE, Continuous Internal Evaluation; ESE, End Semester Evaluation; L, lecture; T, Tutorial; P, Practical

TUTORIAL ASSIGNMENTS

Tutorials should be planned to enhance learning. The faculty shall decide suitable assignments minimum one per unit based on the curriculum.



V	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.	7	15
Total		36	70

SUGGESTED PRACTICALS/DEMONSTRATION

Sr. No		Hours
1.	Radiation Quantities and Units	15
2.	Biological Effects of radiation	15
3.	Radiation detection and Measurements Survey meter and personal dosimeter Artificial Intelligence in Radiation Safety	15
4.	Radiation protection; Principles of radiation protection; ALARA	15
5.	Radiation Hazard evaluation and control	12
		72

Evaluation System

Continuous Internal Evaluation (CIE)

Sl. No.	Component	Marks	Weightage	IA marks
1.	Sessional test(s)			
	Two Written tests Same pattern as Summative test Average of two to be considered Absence without prior permission to be marked as 0	50		
	Total	50	0.3	15
2.	Continuous assessment			
	Seminars/Case presentations/ Logbook/ Case records/Record book/assignment			
	Total	50	0.3	15
	Total CIE marks			30













M.J. Jurelga / Dr. Jurelga
 Director / Head
 Dr. Jurelga / Dr. Jurelga
 Director / Head
 Dr. Jurelga / Dr. Jurelga
 Director / Head

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SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication
1	Radiation Protection in Diagnostic X-Ray Imaging	Euclid Seeram, Patrick C. Brennan	Jones and Bartlett Publishers
2	Development of Radiation Protection in Diagnostic Radiology	Stewart C. Bushong	CRC Press inc., U.S.
3	Textbook of audiological Safety	Thayalan K	Jaypee Brothers Medical Publishers
4	Radiation Protection in Medical Radiography	Statkiewicz Sherer	Elsevier Health - US;
5	Basics of Radiation, Hazards and Prevention in Diagnostic Radiology	Prashant Kumar Jha	JBD Publications

	<p>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- image distortion for digital imaging devices. LASER printer calibration</p>		
II	<p>QA in Diagnostic Radiology</p> <p>filtration</p> <p>Contact between film and intensifying screen</p> <p>Contrast Verification of Optical and Radiation field congruence</p> <p>Beam alignment</p> <p>Focal spot size</p> <p>Linearity of tube current mA and Timer</p> <p>Applied potential</p> <p>HVT and total tube</p> <p>Resolution</p> <p>Grid alignment</p> <p>QA in mammography</p> <p>QA in CT</p> <p>QA in Digital Radiography</p>	4	--
III	<p>Regulatory requirements in Diagnostic Radiology</p> <p>National Regulatory Body</p> <p>Responsibilities and organization</p> <p>Safety Standards</p> <p>Codes and Guides</p> <p>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</p>	4	--

2.	<p>QA in Diagnostic Radiology</p> <p>filtration</p> <p>Contact between film and intensifying screen</p> <p>Contrast Verification of Optical and Radiation field congruence</p> <p>Beam alignment</p> <p>Focal spot size</p> <p>Linearity of tube current mA and Timer</p> <p>Applied potential</p> <p>HVT and total tube</p> <p>Resolution</p> <p>Grid alignment</p> <p>QA in mammography</p> <p>QA in CT</p> <p>QA in Digital Radiography</p>	8				
<table border="1"> <tr> <td>Mr. Anandti</td> <td>Kalpna Bankoti</td> <td>Dr. Ganima Srivastav</td> <td>Dr. Himanshu Thakral</td> </tr> </table>			Mr. Anandti	Kalpna Bankoti	Dr. Ganima Srivastav	Dr. Himanshu Thakral
Mr. Anandti	Kalpna Bankoti	Dr. Ganima Srivastav	Dr. Himanshu Thakral			
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End Semester Evaluation (ESE)

There shall be practical examination for 70 marks in the subject.

Distribution of marks for ESE practical exams:

ESE		CIE		Grand total
Practical	Viva		Sub Total	
50	20	30	100	100

SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication
1	Quality Assurance and Control in Diagnostic Radiology and Imaging	Bhargava	CBS Publishers and Distributors
2	Quality Assurance	Dr. R. Sundararajan, M.V. Kumudhavalli, Minal T. Harde	Thakur Publications Pvt Ltd
3	Quality Assurance in Diagnostic Radiology	J. McLemore (Author)	Imprint unknown
4	An Introduction to Quality Assurance in Radiology	Zafar Neyaz	JBD Publications

BMRIT Radiology Clinical Education – part V (studentship)

Students will gain additional skills in clinical procedures, interaction with patients and professional personnel. Students apply knowledge from previous clinical learning experience under the supervision of a senior technologist. Students are tested on intermediate clinical radio diagnosis skills.

Studentship or observership must include:

- A minimum of 14 hours per week is considered as studentship in every semester.
- Provide simulation and skill labs for practicing skills specific to the program in the initial years of observership/studentship.
- Every semester must have seminars/workshops on new developments/ technologies. Check annexure for marking criteria.
- If the clinical facility is not within the same campus, transportation should be provided to the students and interns.
- All practical skills must be supervised and recorded in a Logbook and skills to be evaluated after the completion of the internship.



Subject: Basics Techniques in MRI Technology**Subject Code: BMRIT - 026****RATIONALE**

Magnetic Resonance Imaging (MRI) is a non-invasive imaging technology that produces three dimensional detailed anatomical images. It is often used for disease detection, diagnosis, and treatment monitoring. It is based on sophisticated technology that excites and detects the change in the direction of the rotational axis of protons found in the water that makes up living tissue. The student learn to Recognize and planning different protocols and prepare and position patients for MRI examination. To gain knowledge on Management of patients, contrast reactions MRI Safety.

COURSE OUTCOMES

At the end of the course students will be able to...

CO1: Define basic principle and physics of Magnetic Resonance Imaging.

CO2: Recognize protocols needed for Magnetic Resonance Imaging examination.

CO3: Prepare and positioning for Magnetic Resonance Imaging examination.

CO4: Interpret post processing of Magnetic Resonance Imaging images.

CO5: Prepare and position the patients for Magnetic Resonance Imaging examination.

CO6: Categorize knowledge of improving image quality in Magnetic Resonance Imaging.

CO7: Scanning of patient with various Magnetic Resonance Imaging protocols for better representation of images.

CO8: Plan of post processing for Magnetic Resonance Imaging data.

CO9: Management of patient for any post contrast reactions.

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme				
L	T	P		Theory Marks		Practical Marks		Total Marks
				CIE	ESE	CIE	ESE	
3	1	8	8	30	70	30	70	200

CIE, Continuous Internal Evaluation; ESE, End Semester Evaluation; L, lecture; T, Tutorial; P, Practical

TUTORIAL ASSIGNMENTS

Tutorials should be planned to enhance learning. The faculty shall decide suitable assignments minimum one per unit based on the curriculum.



Evaluation System**Continuous Internal Evaluation (CIE)**

Sl. No.	Component	Marks	Weightage	IA marks
1.	Sessional test(s)			
	Two Written tests Same pattern as Summative test Average of two to be considered Absence without prior permission to be marked as 0	50		
	Total	50	0.3	15
2.	Continuous assessment			
	Seminars/Case presentations/ records/Record book/assignment Logbook/ Case			
	Total	50	0.3	15
	Total CIE marks			30

End Semester Evaluation (ESE)**Written Paper**

Type of question	No. of questions	Marks per question	Total
Essay Question (EQ)	3 (to answer 2)	10	20
Short Essay Question (SEQ)	9 (to answer 7)	5	35
Short Answer Question (SAQ)	7 (to answer 5)	3	15
Total marks			70
Duration (minutes)			150

**End Semester Evaluation (ESE)**

There shall be practical examination for 70 marks in the subject.

Distribution of marks for ESE practical exams:

ESE		CIE		Grand total
Practical	Viva		Sub Total	
50	20	30	100	100

Subject: Introduction to Nuclear Medicine Techniques**Subject Code: BMRIT -027****RATIONALE**

It is the branch of medicine that deals with the use of radioactive substances in research, diagnosis, and treatment disease. In this student will learn about the fundamentals of radioactivity and various interactions of radiation with matter, radiopharmaceuticals, instrumentations measuring radioactivity,



PET imaging and patients care and safety.

At the end of the course students will be able to...

CO1: Define basic principle and physics of nuclear medicine.

CO2: Apply precautions while handling radiopharmaceuticals.

CO3: Recognizing the artefacts associated with nuclear medicine.

CO4: Assess the knowledge of improving image quality in nuclear medicine.

CO5: Management of patient for any late reactions associated with radiotracers in nuclear medicine.

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme				
				Theory Marks		Practical Marks		Total Marks
L	T	P	C	CIE	ESE	CIE	ESE	100
1	1	2	3	30	70	--	--	

CIE, Continuous Internal Evaluation; ESE, End Semester Evaluation; L, lecture; T, Tutorial; P, Practical

TUTORIAL ASSIGNMENTS

Tutorials should be planned to enhance learning. The faculty shall decide suitable assignments minimum one per unit based on the curriculum.

Evaluation System**Continuous Internal Evaluation (CIE)**

Sl. No.	Component	Marks	Weightage	IA marks
1.	Sessional test(s)			
	Two Written tests Same pattern as Summative test Average of two to be considered Absence without prior permission to be marked as 0	50		
	Total	50	0.3	15
2.	Continuous assessment			
	Seminars/Case presentations/ Logbook/ Case records/Record book/assignment			
	Total	50	0.3	15
	Total CIE marks			30

End Semester Evaluation (ESE)**Written Paper**

Type of question	No. of questions	Marks per question	Total
Essay Question (EQ)	3 (to answer 2)	10	20
Short Essay Question (SEQ)	9 (to answer 7)	5	35
Short Answer Question (SAQ)	7 (to answer 5)	3	15
Total marks			70
Duration (minutes)			150

**Question Paper Blueprint**

Unit		Marks ($\pm 5\%$)
1.	History; Isotopes and Radionuclides- Production of Radionuclides, Transport of Radionuclides; Radio Activity- Radio Active transformations, Specific Activity; Radiopharmaceuticals- Preparation, Precautions while handling	32
2.	Gamma Camera instrumentation - Collimator- classification and types; Single Photon Emission Computed Tomography (SPECT); Positron Emission Tomography (PET); Advanced techniques in NM - SPECT-CT, PET-CT, PET-MRI	32
3.	Safety Considerations & Radiation Dose in Nuclear Medicine; Room layout in nuclear medicine	32
	Total Marks (including optional questions)	96

Subject: Ultrasound Techniques**Subject Code: BMRIT -028****RATIONALE**

Ultrasound techniques provide students' knowledge on the basic principles of ultrasonography and how to prepare the patients for the scan and also to identify any artefacts. To learn about the physics behind ultrasound and to gain knowledge regarding various ultrasound procedures equipment used in ultrasound and patient care during ultrasound procedures

COURSE OUTCOMES

At the end of the course students will be able to...

CO001: Describe the Ultrasound properties, interaction of ultrasound with matter

CO002: Describe the transducer and types

CO003: Explain the concepts of image display

CO004: Describe Doppler imaging and ultrasound contrast agents

CO005: Describe the image characteristics and artefacts

CO006: explain the safety considerations in ultrasound and protocols

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme				
L	T	P		Theory Marks		Practical Marks		Total Marks
				CIE	ESE	CIE	ESE	
2	1	--	3	30	70	--	--	100

CIE, Continuous Internal Evaluation; ESE, End Semester Evaluation; L, lecture; T, Tutorial; P, Practical

TUTORIAL ASSIGNMENTS

Tutorials should be planned to enhance learning. The faculty shall decide suitable assignments minimum one per unit based on the curriculum.

Dr. Jyoti S. Patil	Dr. K. S. Patil	Dr. S. S. Patil	Dr. P. S. Patil

Sr. No		Hours
4.	Doppler Imaging: Doppler principles, continuous wave Doppler and pulsed Doppler, duplex scanning, colour flow imaging, power doppler, harmonic imaging, extended field of view Ultrasound contrast agents	6
5.	Image characteristics and artefacts	6
6.	Bio-effects and safety considerations in ultrasound, ultrasound system performance measurements, ultrasound equipments quality assurance	6
Total		36

Evaluation System

Continuous Internal Evaluation (CIE)

Sl. No.	Component	Marks	Weightage	IA marks
1.	Sessional test(s)			
	Two Written tests Same pattern as Summative test Average of two to be considered Absence without prior permission to be marked as 0	50		
	Total	50	0.3	15
2.	Continuous assessment			
	Seminars/Case presentations/ Logbook/ Case records/Record book/assignment			
	Total	50	0.3	15
	Total CIE marks			30

End Semester Evaluation (ESE)

Written Paper

Type of question	No. of questions	Marks per question	Total
Essay Question (EQ)	3 (to answer 2)	10	20
Short Essay Question (SEQ)	9 (to answer 7)	5	35
Short Answer Question (SAQ)	7 (to answer 5)	3	15
Total marks			70
Duration (minutes)			150

Handwritten signatures and stamps of faculty members, including names like Dr. Srinivas, Dr. Srinivas, and Dr. Srinivas, along with dates and initials.

Subject: Biostatistics and Research Methodology**Subject Code: BMRIT -029****RATIONALE:**

The application of statistical techniques to scientific research in health-related fields, including medicine, biology, and public health, and the development of new tools to study these areas.

COURSE OUTCOMES

At the end of the course students will be able to...

CO1: Understand the Importance of statistics course in the curriculum

CO2: Understands Statistical Terms


CO3: Possess Knowledge and Skill in the use of Basic Statistics in the analysis and interpretation of data

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme
L	T	P	C	
1	1	--	2	Institute level exam only: The Institute level examination will be held before the commencement of the University examinations. A Pass in the subject with a minimum of 50 marks (50% of the total 100 marks) is compulsory in order to be eligible for the award of degree. These marks will not be considered for the award of class. Supplementary examination shall be conducted by the Institute for the benefit of unsuccessful candidates. Supplementary examinations will be conducted within six weeks / Six months from the date of announcement of results.

L, lecture; T, Tutorial; P, Practical

THEORY COMPONENTS

The following topics/subtopics should be taught and assessed in order to attain the identified competency.

Unit	Topic and contents	Hours
I	Introduction: Meaning, Definition, Characteristics of Statistics; Importance of the Study of Statistics. Branches of Statistics; Descriptive and Inferential Statistics; Variables and Their Types. Measurement Scales.	3
II	Tabulation of Data: Raw Data, the Array, Frequency Distribution. Basic Principles of Graphical Representation; Types of Diagrams - Histograms, Frequency Polygons, Smooth Frequency Polygon, Commutative Frequency Curve, O give; Normal Probability Curve.	3
		

BMRIT Radiology Clinical Education – part IV (studentship)

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- All practical skills must be supervised and recorded in a Logbook and skills to be evaluated after the completion of the internship.

Md Inuliyas Ansari	Kalpna Bankoti	Dr. Goniama Srivastav	Dr. Himanshu Thakral
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