

MALLA REDDY VISHWAVIDYAPEETH

SCHOOL OF ALLIED HEALTHCARE SCIENCES & TECHNOLOGY

**Suraram X Roads, Jeedimetla, Hyderabad-
500055**

Website: <https://mrvv.edu.in/>

Program:

Bachelor of Science (B.Sc.)

Medical Radiology and imaging Technology

2025



**MALLA REDDY
VISHWAVIDYAPEETH**
(Deemed to be University)

MALLA REDDY VISHWAVIDYAPEETH

SCHOOL OF ALLIED HEALTHCARE SCIENCES & TECHNOLOGY

Bachelors of Medical Radiology and Imaging Technology**VISION**

To develop highly competent and ethically responsible radiology and imaging technologists who excel in delivering precise diagnostic imaging services, contribute to improved patient care, and actively participate in research and technological advancements in the field of medical imaging.

MISSION**• Academic Excellence:**

To provide strong theoretical knowledge in radiological sciences combined with practical training using modern imaging technologies such as X-ray, CT, MRI, and Ultrasound, ensuring students gain a solid academic foundation.

• Skill Development:

To develop clinical, technical, and analytical skills required for accurate image acquisition, processing, and interpretation, enabling students to support effective diagnosis and treatment planning.

• Ethical and Professional Values:

To inculcate ethical practices, patient safety awareness, radiation protection principles, and professional responsibility in all healthcare settings.

• Technological Competency:

To train students in the operation of advanced imaging equipment and digital systems such as PACS and RIS, preparing them for real-world radiology departments.

• Research and Innovation:

To encourage research-oriented learning, critical thinking, and innovation in imaging techniques and diagnostic procedures.

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

Graduates of the program will:

PEO 1: Clinical Competence

Apply comprehensive knowledge of radiology and imaging technology to perform diagnostic procedures effectively in clinical environments, ensuring accuracy and quality in patient care.

PEO 2: Professional Practice

Assist radiologists and healthcare professionals in diagnostic and interventional imaging procedures with technical proficiency, confidence, and adherence to standard protocols.

PEO 3: Ethical Responsibility

Demonstrate professionalism by maintaining ethical standards, patient confidentiality, radiation safety, and effective communication with patients and healthcare teams.

PEO 4: Lifelong Learning & Research

Engage in continuous professional development through research, advanced education, and adoption of emerging imaging technologies.

PEO 5: Community Engagement

Contribute to public health by promoting early disease detection, participating in screening programs, and creating awareness about diagnostic imaging services.

PROGRAM OUTCOMES (POs)

At the end of the program, students will be able to:

PO 1: Knowledge of Radiology Sciences

Understand and apply fundamental and advanced concepts of radiology, imaging modalities, and medical physics in clinical practice.

PO 2: Technical Skills in Imaging

Perform and assist in diagnostic procedures including X-ray, CT, MRI, Ultrasound, and fluoroscopy with precision and adherence to protocols.

PO 3: Image Analysis & Interpretation Support

Analyze imaging data, identify normal and abnormal findings, and assist radiologists in diagnosis and treatment planning.

PO 4: Integration of Medical Sciences

Apply knowledge of anatomy, physiology, pathology, and radiological physics for accurate imaging and patient assessment.

PO 5: Radiation Safety & Patient Care

Implement radiation protection principles, infection control measures, and patient safety protocols in all imaging procedures.

PO 6: Communication & Teamwork

Communicate effectively with patients, radiologists, and multidisciplinary healthcare teams to ensure coordinated patient care.

PO 7: Equipment Handling & Digital Systems

Operate and manage modern imaging equipment and digital systems such as PACS (Picture Archiving and Communication System) and RIS (Radiology Information System).

PO 8: Critical Thinking & Problem Solving

Demonstrate analytical thinking and problem-solving skills in optimizing imaging techniques and managing technical challenges.

PO 9: Research & Evidence-Based Practice

Participate in research activities and apply evidence-based practices to improve imaging quality and diagnostic outcomes.

PO 10: Lifelong Learning

Pursue continuous learning and professional development to adapt to advancements in radiology and healthcare technology.

PROGRAM SPECIFIC OUTCOMES (PSOs)

On completion of the program, students will be able to:

PSO 1: Diagnostic Imaging Expertise

Perform a wide range of diagnostic imaging procedures including X-ray, CT scan, MRI, Ultrasound, and Mammography with competence.

PSO 2: Interventional Support

Assist in interventional radiology and image-guided procedures while maintaining sterile techniques and patient safety.

PSO 3: Equipment Operation & Maintenance

Operate, maintain, and troubleshoot radiological equipment to ensure optimal performance and minimize downtime.

PSO 4: Radiation Protection

Apply radiation safety principles to protect patients, staff, and the public from unnecessary exposure.

PSO 5: Image Quality Optimization

Identify and correct imaging artifacts and optimize imaging parameters for high-quality diagnostic images.

PSO 6: Emergency Imaging Skills

Provide efficient imaging support in emergency and trauma situations with quick decision-making and technical accuracy.

PSO 7: Professional Readiness

Work effectively in hospitals, diagnostic centers, and radiology departments with professional competence and adaptability.

COURSE OUTCOMES (COs)

At the end of the course, students will:

CO 1: Fundamental Understanding

Understand the basic and advanced principles of radiology, imaging science, and diagnostic techniques.

CO 2: Patient Positioning & Procedure Execution

Demonstrate accurate patient positioning and perform imaging procedures effectively while ensuring patient comfort and safety.

CO 3: Image Interpretation Support

Interpret basic radiographic images and assist radiologists in advanced imaging analysis.

CO 4: Advanced Imaging Knowledge

Apply knowledge of CT, MRI, Ultrasound, and digital imaging systems in clinical practice.

CO 5: Safety & Ethics

Adhere to radiation safety standards, biomedical ethics, and quality assurance protocols in radiology practice.

CO 6: Technical Competency

Develop proficiency in handling and operating modern imaging equipment and technologies.

CO 7: Clinical Support

Assist healthcare teams in diagnosis, treatment planning, and patient management.

CO 8: Research & Analytical Skills

Demonstrate research aptitude, critical thinking, and analytical skills in imaging sciences.



MALLA REDDY VISHWAVIDYAPEETH**SCHOOL OF ALLIED HEALTHCARE SCIENCES AND TECHNOLOGY****Bachelor of Medical Radiology and Imaging Technology****COURSE STRUCTURE****I YEAR I SEMESTER**

S.NO	SUBJECT CODE	SUBJECT	L	T	P	C	Max. Marks		
							IN T	EX T	TOT AL
1		Human Anatomy - I	4	-	-	4	30	70	100
2		Human Physiology - I	4	-	-	4	30	70	100
3		Medical Bio-chemistry- I	4	-	-	4	30	70	100
4		Sociology	2	-	-	2	30	70	100
5		English and Communication Skills	1	-	2	2	30	70	100
6		Basic Computers	1	-	2	2	30	70	100
7		Human Anatomy - I Practical	-	-	4	2	30	70	100
8		Human Physiology - I Practical	-	-	4	2	30	70	100
TOTAL			16	-	12	22	240	560	800

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I YEAR II SEMESTER

S.NO	SUBJECT CODE	SUBJECT	L	T	P	C	Max. Marks		
							INT		
1		Human Anatomy - II	4	-	-	4	30	70	100
2		Human Physiology - II	4	-	-	4	30	70	100
3		Basics of Radiation Physics	2	-	2	3	30	70	100
4		Microbiology	3	-	-	3	30	70	100
5		Pathology	2		-	2	30	70	100
6		Medical Terminology & Principals of <u>Managment</u>	1	-	-	1	30	70	100
7		Clinical Radiography Positioning (Part I)	2	-	4	4	30	70	100
8		Clinical Posting	-	-	6	3	100	-	-
9		Human Anatomy – II Practical	-	-	4	2	30	70	100
10		Human Physiology – II Practical	-	-	2	1	30	70	100
11		Stress Management	1	-	-	1	100	-	100
TOTAL			19	-	18	28	470	630	1100

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II YEAR III SEMESTER

S.NO	SUBJECT CODE	SUBJECT	L	T	P	C	Examination Scheme								Grand TOTAL	
							Theory				Practical					
							Exam Duration Hours	CIE	ESE	Total		CIE	ESE	Total		TOTAL
								Max Marks	Max Marks	Max marks	Min Marks	Max Marks	Max Marks	Max Marks	Min marks	
1.	BMRIT-015	Pathology	2	--	--	2	2.5	30	70	100	50	--	--	--	--	100
2.	BMRIT-016	Clinical Radiography Positioning (Part II)	2	1	6	6	2.5	30	70	100	50	30	70#	100	50	200
3.	BMRIT-017	Radiography and Image Processing Techniques	2	--	2	3	2.5	30	70	100	50	--	--	--	--	100
4.	BMRIT-018	Contrast Media &Special Radiological Procedures	2	1	6	6	2.5	30	70	100	50	30	70#	100	50	200
5.	-----	BMRIT Radiology Clinical Education -Part III (Studentship)	--	--	12	4	--	--	--	--	--	--	--	--	--	--
TOTAL			6	4	26	21	--	--	--	400	--	--	--	200	--	600

II YEAR IV SEMESTER

S.NO	SUBJECT CODE	SUBJECT	L	T	P	C	Examination Scheme								Grand TOTAL	
							Theory				Practical				TOTAL	
							Exam Duration Hours	CIE	ESE	Total		CIE	ESE	Total		
								Max Marks	Max Marks	Max marks	Min Marks	Max Marks	Max Marks	Max Marks		Min marks
1.	BMRIT-019	Cross sectional anatomy	2	--	6	5	--	--	--	--	70#	30	100	50	100	
2.	BMRIT-020	Modern Radiological Imaging Equipment and Physics	2	1	2	3	2.5	70	30	100	50	--	--	--	--	100
3.	BMRIT-021	Interventional Radiology Techniques	2	1	4	4	2.5	70	30	100	50	70#	30	100	50	200
4.	BMRIT-022	Patient Care in Radiology	1	1	4	4	2.5	70	30	100	50	70#	30	100	50	200
5.	-----	BMRIT Radiology Clinical Education – part IV (studentship)	--	--	12	4	--	--	--	--	--	--	--	--	--	--
TOTAL			7	3	26	22	--	--	--	300	--	--	--	300	--	600

III YEAR V SEMESTER

S.NO	SUBJECT CODE	SUBJECT	L	T	P	C	Examination Scheme								Grand TOTAL	
							Theory				Practical				TOTAL	
							Exam	CIE	ESE	Total		CIE	ESE	Total		
							Duration Hours	Max Marks	Max Marks	Max marks	Min Marks	Max Marks	Max Marks	Max Marks		Min marks
1.	BMRIT-023	Basics Techniques in CT Technology	4	1	8	9	2.5	30	70	100	50	30	70#	100	50	200
2.	BMRIT-024	Radiation Safety in Diagnostic Radiology	2	1	4	5	2.5	30	70	100	50	30	70#	100	50	200
3.	BMRIT-025	Quality Assurance in Diagnostic Radiology and Regulatory Requirements	1	1	2	3	--	--	--	--	--	30	70#	100	50	100
4.	-----	BMRIT Radiology Clinical Education – part V (studentship)	--	--	12	4	--	--	--	--	--	--	--	--	--	--
TOTAL			7	3	26	21	--	--	--	200	--	--	--	300	--	500

III YEAR VI SEMESTER

S.NO	SUBJECT CODE	SUBJECT	L	T	P	C	Examination Scheme								Grand TOTAL	
							Theory				Practical					
							Exam	CIE	ESE	Total		CIE	ESE	Total		
							Duration Hours	Max Marks	Max Marks	Max marks	Min Marks	Max Marks	Max Marks	Max Marks	Min marks	TOTAL
1.	BMRIT-026	Basics Techniques in MRI Technology	3	1	8	8	2.5	30	70	100	50	30	70#	100	50	200
2.	BMRIT-027	Introduction to Nuclear Medicine Techniques	1	1	2	3	2.5	30	70	100	50	--	--	--	--	100
3.	BMRIT-028	Ultrasound Techniques	2	1	--	3	2.5	30	70	100	50	--	--	--	--	100
4.	BMRIT-029	Biostatistics And Research Methodology	1	1	--	2	--	30	70*	100	50	--	--	--	--	--
5.	-----	BMRIT Radiology Clinical Education – part VI (studentship)	--	--	15	5	--	--	--	--	--	--	--	--	--	--
TOTAL			7	4	25	21	--	--	--	300	--	--	--	100	--	400

IV YEAR VII SEMESTER

S.NO	L	T	P	C	Examination Scheme								TOTAL		
					Theory					Practical					
					Exam Durati on Hours	CIE	ESE	Total		CIE		ESE*			
						Max Marks	Min Mark s	Max marks	Min Marks	Max Marks	Min Marks	Max Marks	Min marks	Max Marks	Min marks
1.	-	-	-	20	-	-	-	-	-	100	50	100	50	200	100

IV YEAR VIII SEMESTER

S.NO	L	T	P	C	Examination Scheme									TOTAL	
					Theory					Practical					
					Exam	CIE	ESE	Total		CIE		ESE*			
					Duration Hours	Max Marks	Min Marks	Max marks	Min Marks	Max Marks	Min Marks	Max Marks	Min marks	Max Marks	Min marks
1.	-	-	-	20	-	-	-	-	-	100	50	100	50	200	100

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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

1.1 Under Graduate Programme

Sl. No.	Course	Duration	Eligibility for admission
1.	Bachelor of Medical Radiology and imaging Technology	4 years	Intermediate BiPC, vocational /Diploma (with bridge course), 10+2 with Physics, Chemistry and Biology or equivalent Background Course Subjects

1.2. Medium of Instruction:

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

1.3. Duration of the Course

Duration details are mentioned under clause no. 1.1 of this booklet.

1.4 Examination Regulations

1.4.1 Attendance: 75% of attendance (physical presence) is mandatory.

Medical leave or other types of sanctioned leaves will not be counted as physical presence.

Attendance will be counted from the date of commencement of the session to the last day of the final examination in each subject

1.4.2 Internal Assessments:

- a) Regular periodic assessment shall be conducted throughout the course. In each semester there will be **two one hour internal assessments (10 marks each)** and a continuous assessment **(10 marks)**.

Thus a total of 30 marks for the internal exam. (i.e. weightage for internal assessment shall be 30% of the total marks in each subject).

- b) The examination pattern for internal assessment in each semester shall be as follows:"

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- (a) Short questions 3 nos. out of which the student should write two questions each carrying 5 marks (i.e. $2 \times 5 = 10$ marks) . Two such internal examinations will be conducted.

- (b) Continuous assessment of the student will be done. Students' overall attendance, performance in class, behavior of the student, extra-curricular activities etc. will be assessed. Continuous assessment carries 10 marks.

- (d) Thus, a total of 30 marks for the internal examination. ($10 + 10 + 10 = 30$ marks). A candidate should secure a minimum of 40% marks in the internal assessment in each subject to be eligible to appear for the University examination

- (e) For value added courses, only internal examination will be conducted. The assessment comprised of five assignments/presentations/case presentations each carrying 10 (i.e. $5 \times 10 = 50$

marks). Final examination will be for 50 marks with 5 questions each carrying 10 marks ($5 \times 10 = 50$ marks). The minimum pass is 40% marks.

1.4.3 University Examinations:

a) University Examination shall be conducted at the end of every semester.

b) A candidate who satisfies the requirement of attendance and internal assessment marks, as stipulated by the University shall be eligible to appear for the University Examination.

c) Examination will be of 3 hours duration (for theory). The question pattern for those subjects without practical examination (70 marks) will be (a) Three essay questions out of which the student should answer 2 questions each carrying 10 marks (i.e. $2 \times 10 = 20$ marks) (b) Eight short note questions out of which the student should attempt six questions, each carrying 5 marks ($6 \times 5 = 30$ marks). (c) Ten very short questions each carrying 2 marks (i.e. $10 \times 2 = 20$ marks). Thus, a total of 70 marks.

d) Examination will be of 3 hours duration (for theory). The question pattern for those subjects with practical examination (70 marks) will be (a) Three essay questions out of which the students should answer two questions each carrying 10 marks (i.e. $2 \times 10 = 20$ marks) (b) Eight short note questions out of which the student should attempt six questions, each carrying 5 marks ($6 \times 5 = 30$ marks). (c) Spotters/major practical/minor practical/Viva/practical record carries 20 marks. Thus, a total of 70 marks.

e) The question pattern for practical examination (a) Spotters/major practical/minor practical/Viva/practical record.

The minimum pass for internal assessment is 40% and for the University Examination is 50%. i.e. a student should score a total of 50% (adding the internal and external examination) to pass in each subject.

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Semester- I

HUMAN ANATOMY-1

L/T/P/C**4/-/-/4****Learning Objectives:**

- Develop a clear understanding of basic human anatomy and Histology, including structure and organization of tissues, organs, and systems.
- Identify and describe anatomical structures of the upper extremity, thorax, and major body systems, along with their functions and relationships.
- Apply anatomical knowledge to clinical contexts, especially in understanding organ systems relevant to patient care and dialysis practice.

Learning Outcomes:

- Demonstrate the ability to recognize and explain the structure and function of major organs and systems such as the Cardiovascular System and Urinary System.
- Correlate anatomical and histological knowledge with clinical procedures and patient management in healthcare settings.
- Exhibit competency in identifying anatomical landmarks and understanding their relevance in diagnostic and therapeutic procedures.

UNIT-I (12 hours)**GENERAL ANATOMY AND HISTOLOGY****General Anatomy:**

- Fascia
- Muscles
- Bones
- Joints
- Vessels
- Nerve

General Histology:

- Epithelial
- Connective tissue
- Muscle
- Bone and cartilage
- Nerves and vessels
- Embryology

UNIT-II (12 hours)**UPPER EXTREMITY :**

- Osteology: Clavicle, Scapula, Humerus, Radius, Ulna, Carpals, Metacarpals, Phalanges.
- Muscles: Origin, insertion, nerve supply, and actions.

UNIT-3 (12 hours)

UPPER EXTREMITY :

- Joints: Shoulder girdle, shoulder joint, elbow joints, radioulnar joint, wrist joint, and joints of the hand.
- Breast, pectoral region, axilla, cubital fossa, arch of the hand
- Brachial plexus, nerves of the upper extremity
- Blood vessels and lymphatic drainage

UNIT – 4 (12 hours)

CARDIOVASCULAR&RESPIRATORYANATOMY

- Thoracic wall
- Mediastinum
- Heart: Anatomy of heart, blood supply, nerve supply, conducting system, conducting System and major blood vessels
- Lungs: Anatomy of lungs, bronchial tree, pleura, bronchopulmonary segments, blood Supply, and nerve supply
- Diaphragm: Origin, insertion, nerve supply, and action, openings in the diaphragm.
- Intercostal muscles and accessory muscles of respiration: Origin, insertion, nerve supply, and action
- Ribs and sternum

UNIT-V (12 hours)

SYSTEMICANATOMY

1. Digestive system:

List the parts of the digestive system

Anatomy of the stomach, liver, gallbladder, spleen, pancreas, and intestines.

2. Urinary system:

Anatomy of the kidney, urinary bladder

3. Endocrine system:

Position and hormones secreted by each organ

4. Genital system:

Male organs and female organs

RECOMMENDED TEXT BOOKS

1. Human Anatomy-Snell
2. Anatomy- Chaurasia, Volume, and III
3. Neuroanatomy-Inderbir Singh
4. Human Anatomy- Kadasne, Volume, and III
5. Neuroanatomy— Vishram Singh
6. Human Anatomy- Datta

HUMANPHYSIOLOGY-I**L/T/P/C****4/-/-/4****Learning Objectives:**

- Understand the fundamental principles of human physiology, including Homeostasis, cell function, and mechanisms of transport across cell membranes.
- Describe the structure and functions of major systems such as the Cardiovascular System, Respiratory System, and blood physiology.
- Explain physiological processes related to nerve conduction, muscle contraction, and exercise, and their role in maintaining normal body function.

Learning Outcomes:

- Demonstrate the ability to explain normal physiological mechanisms of the body, including circulation, respiration, and neuromuscular activity.
- Apply knowledge of physiological principles to interpret basic clinical conditions such as Anemia, blood pressure variations, and respiratory changes.
- Correlate physiological responses during rest and exercise, enabling understanding of patient monitoring and care in clinical settings.

UNIT-I (12 hours)**GENERALPHYSIOLOGY****Cell:**

- Structure of the cell membrane
 - Fluid Mosaic Model
 - Lipid bilayer
 - Functions of the cell membrane
- a) **Transport across the cell membrane**

- Basic mechanism of transport
- Channel proteins
- Carrier proteins
- Methods of transport
- Passive transport
- Active transport

b) Body fluids

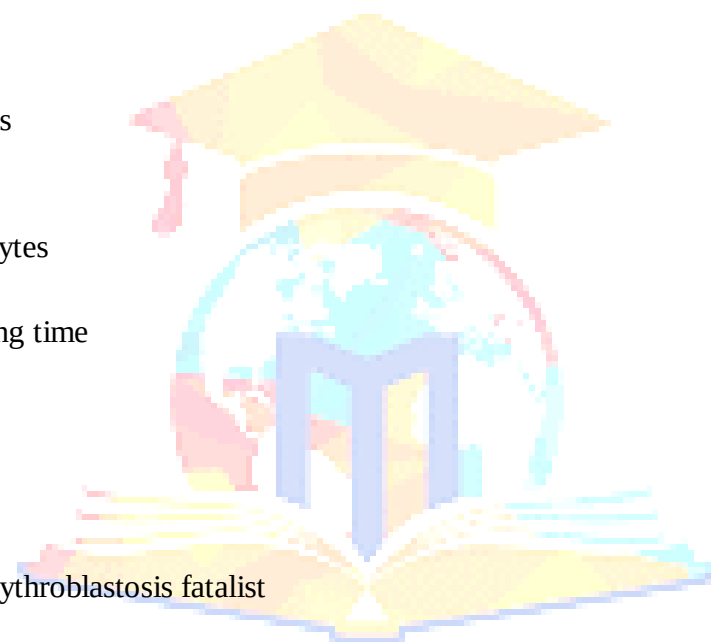
- Intracellular fluid
- Extracellular fluid
- Body electrolytes
- Regulation of body fluid volume

Homeostasis

- Regulation of body function
- Homeostatic regulatory mechanism

BLOOD

- Composition of blood & its volume
- Plasma
- Hemopoietin
- Composition
- Plasma protein
- Erythrocytes
- Normal count
- Structure of RBC (shape & size)
- Functions of RBC
- Hemoglobin (Normal Value, Fate, Function)
- Anemia & polycythemia
- ESR & PCV
- Leukocytes
- Classification
- Functions of leukocytes
- Platelets
- Normal count
- Functions of thrombocytes
- Blood Coagulation
- Bleeding time & clotting time
- Blood group
- ABO system
- Landsteiner's law
- ABO incompatibility
- Rh system
- Rhincompatibility & erythroblastosis fatalist
- Blood transfusion
- Collection & storage of blood
- Precautions
- Cross-matching
- Hazards of blood transfusion



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NERVE:

- Structure of a neuron
- Classification of neurons
- Electrical activity of a neuron
- Resting membrane potential
- Action potential
- Propagation of nerve impulse
- Properties of nerve fibres
- Neuroglia-Types & functions
- Nerve Injury
- Types of Nerve Injury
- Effect of Nerve Injury

- Regeneration of damaged nerve fibre

UNIT-II (12 hours)**MUSCLE PHYSIOLOGY**

- Classification
- Properties of skeletal muscle
- Structure of skeletal muscle
- Sarcomere
- Sarcotubular system
- Neuromuscular junction & disease affecting it
- Excitation-Contraction coupling
- Mechanism of muscle contraction
- Functions of skeletal muscle
- Types of muscle contractions
- Red & white muscles
- Rigor mortis, muscular dystrophy, altered muscle tone, muscle cramp, atrophy, EMG

UNIT-III (12 hours)**CARDIOVASCULAR SYSTEM**

- Structure of heart & blood vessels
- Properties of cardiac muscle
- Origin & spread of cardiac pulse
- Cardiac cycle & heart sounds
- Cardiac output
- Related terms
- Regulation of cardiac output
- Circulatory shock
- Pulse & Heart rate and its regulation
- Blood pressure
- Definitions
- Factors controlling & Influencing BP
- Regulation of BP
- Regional circulation
- Coronary circulation
- Cerebral circulation
- Normal ECG

UNIT-IV (12 hours)**RESPIRATORY SYSTEM**

- Introduction, structure & function of RS
- Upper respiratory tract
- Lower respiratory tract
- Respiratory membrane

- Mechanism of breathing
- Mechanisms of Breathing
- Respiratory pressure change
- Compliance
- Surfactant
- Respiratory volumes & capacities
- Pulmonary ventilation & Dead space
- Transport of respiratory gases
- Nervous & chemical regulation of respiration
- Pulmonary function test –direct & indirect method
- Physiological changes with altitude & acclimatization

UNIT-V (12 hours)

EXERCISE PHYSIOLOGY

- Basal Metabolic Rate & Respiratory Quotient
- Energy metabolism
- Fatigue
- Oxygen debt
- Acute cardio vascular changes during exercise ; difference between mild, moderate & severe exercise
- Concept of Endurance
- Acute respiratory changes during exercise
- Concept of training/conditioning; effects of long-term exercise/training on the CVS & RS
- Body temperature regulation during exercise
- Hormonal & metabolic effects during exercise
- Exercise for muscle strength, power, endurance, and its effects on Physical fitness & its components

RECOMMENDED TEXT BOOKS

1. Textbook on Medical Physiology-Guyton
2. Textbook of Physiology-AK Jain (for MBBS students)
3. Human Physiology-C.C. Chatterjee
4. Essentials of Medical Physiology- Sembulingam, K.
5. Comprehensive Textbook of Medical Physiology: Vol-1&2 -Pal, Gopal Krishna
6. Physiology: Prep Manual for Undergraduates-Joshi, Vijaya D.
7. Practical Physiology-Joshi, Vijaya D.

MEDICAL BIOCHEMISTRY-I**L/T/P/C****4/-/-4****Learning Objectives:**

- Understand the structure, classification, and functions of major biomolecules including carbohydrates, lipids, proteins, and Nucleic Acid Chemistry.
- Explain the role of Enzymes, vitamins, and minerals in maintaining normal physiological functions.
- Describe key metabolic pathways such as Glycolysis, TCA cycle, and lipid metabolism, along with their clinical relevance.

Outcomes:

- Demonstrate the ability to explain biochemical processes and their importance in normal body function and energy production.
- Interpret basic biochemical changes in body fluids, aiding in the understanding of clinical conditions such as Diabetes Mellitus and metabolic imbalances.
- Apply knowledge of enzymes, vitamins, and minerals to assess nutritional status and identify deficiency-related disorders.

UNIT-I (12hours)**CARBOHYDRATE CHEMISTRY**

- Definition, general classification with examples
- Composition and function of Monosaccharides and Polysaccharides
- Anomers, Epimers, Enantiomers, Mutarotation
- Glycosaminoglycan's (mucopolysaccharides)

LIPID CHEMISTRY

- Definition, classification with examples.
- Classification and Functions of Fatty Acids, Phospholipids, Lipoproteins
- Structure and function of cholesterol
- Sources and functions of ketone bodies

UNIT-II (12hours)**AMINOACID CHEMISTRY**

- Definition, Classification of Amino Acids with Examples.
- Definition, Classification of Proteins with Examples
- Structural organization of proteins
- Biologically important peptides
- NUCLEIC ACIDS AND NUCLEOTIDE CHEMISTRY
- Composition and Function of Nitrogen bases, Nucleosides, Nucleotides
- Structure and Function of DNA
- Structure, Types, and Functions of RNA
- Differences between DNA and RNA

UNIT-III (12hours)**ENZYMES**

- Definition, Classification of Enzymes with Examples
- Active site, Enzyme specificity.
- Factors affecting enzyme activity
- Enzyme inhibition
- Iso enzymes and their clinical significance, creatine kinase, ALP

VITAMINS

- Definition, Classification
- Fat-soluble Vitamins-Sources, RDA, Functions, and Deficiency.
- Water-soluble Vitamins-Sources, RDA, Functions, and Deficiency

UNIT-IV (12hours)

INTERMEDIARYMETABOILISM

- Glycolysis
- TCA cycle
- B-oxidation of fatty acids (Palmitic acid)
- Ketone body formation and utilization, Urea cycle

UNIT-V (12hours)

MINERAL METABOLISM

- Definition, Classification. Sources, RDA, Functions, and Deficiency of Calcium, Phosphorus, Iron, Sodium, Potassium

CLINICAL BIOCHEMISTRY

- Normal and abnormal constituents of urine and blood and their clinical significance:
- Normal constituents:
- Organic: Urea, Uric acid, Creatinine
- Inorganic: Ca, phosphate, chloride, electrolytes
- Abnormal constituents:
- Glucose, Ketone bodies, Protein, Blood, Bile salts, Bile Pigments

RECOMMENDED TEXT BOOKS

1. Essentials of Biochemistry by U. Satya Narayana.
2. Textbook of Biochemistry for Medical Students. DM Vasudeva
3. Integrated textbook of Biochemistry Volume-I and II. Indumathi.
4. Textbook of Biochemistry for Medical Students. MN Chatterjee and Rana Shinde.
5. Illustrated Biochemistry.
6. Essentials of Biochemistry. Pankaja Naik

SOCIOLOGY

L/T/P/C

2/-/-/2

Learning Objectives

- To understand the basic concepts of sociology, social structure, and their relevance to healthcare.
- To analyse the influence of social factors, culture, family, and community on health and disease.
- To develop awareness about social problems and their impact on individual and public health.

Learning Outcomes

- Students will be able to explain sociological concepts, methods, and their application in healthcare settings.
- Students will assess the role of socialization, family, community, and culture in health and illness.
- Students will identify major social problems and apply sociological knowledge in patient care and health planning.

UNIT 1 (6 hours)

1. Introduction

- Meaning- Definition, Nature and Scope of Sociology
- Methods of Sociological Investigations, Case Study, Social Survey, Questionnaire, and Interview methods.
- Importance of its study with special reference to Health Care Professionals.

2. Social Factors in health and disease situations:

- Role of Social factors in health
- Role of social factors in illness
- Decision-making in taking treatment

UNIT II (6 hours)

1. Socialization:

- Definition and Meaning of Socialization
- Primary, Secondary, and Anticipatory socialization
- Agencies of Socialization

2. Social Groups:

- Definition and Features of Social Group
- Primary Social Group
- Secondary Social Group
- The role of Primary and Secondary Groups in Hospitals.

UNIT III (6 hours)

1. Family:

- The family, meaning, and definition
- Functions of the family

- Changing family patterns
- Influence of Family on the individual's health, the effects of sickness in the family.

2. Community:

- Rural community: meaning and features- Health problems of the rural community.
- Urban community: meaning and features - Health problems in urban areas.

UNIT IV (6 hours)

1. Culture and Health:

- Concept of Health
- Concept of Culture
- Cultural factors affecting Health and diseases

2. Social Change:

- Meaning of social change
- Factors of social change
- Human adaptation and social change
- Social Planning and Health

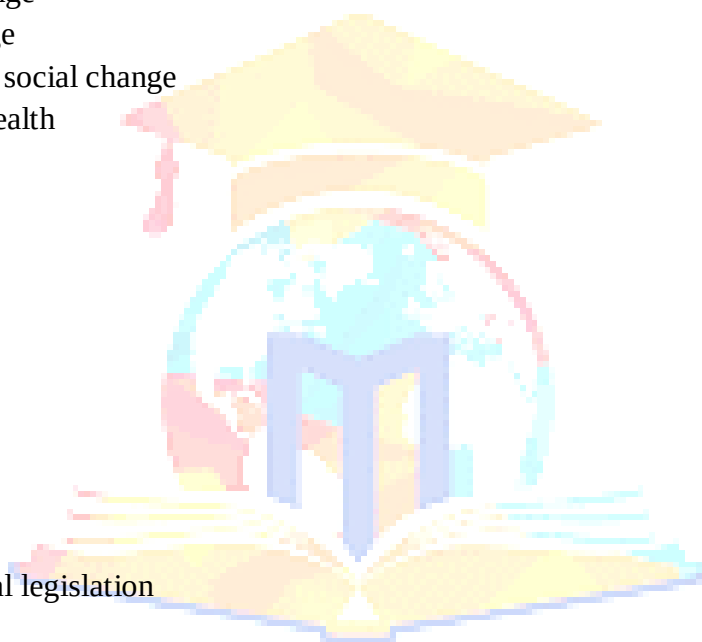
UNIT V (6 hours)

1. Social Problems:

- Population explosion
- Juvenile delinquency
- Alcoholism
- Unemployment
- Poverty
- Problems of women

2. Social Security:

- Social security and social legislation



RECOMMENDED TEXT BOOKS

1. Principles of Sociology --- C.N. Shankar Rao
2. Sociology for physiotherapy students--K.P. Neeraja

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ENGLISH AND COMMUNICATION SKILLS**L/T/P/C****2/-/-2****Learning Objectives**

- To develop reading, comprehension, and critical thinking skills through literary texts.
- To understand themes such as sympathy, work ethics, life stages, and social service.
- To enhance communication skills and appreciation of literature.

Learning Outcomes

- Students will be able to interpret and analyze poems, essays, and letters effectively.
- Students will demonstrate understanding of moral values like empathy, dedication, and service.

UNIT1: Sympathy (Poem) by Charles Mackay (6 hours)

Reading-Reading and its importance, techniques of effective reading.

Writing-Paragraph Writing (Topic sentence, Supporting sentences, and Conclusion) Grammar - Parts of Speech (Parsing), Articles

ELCSLAB

CALLLAB : Phonetics- Vowel Sounds (Monophthongs and Diphthongs)

Listening-Introduction to listening, Purpose of Listening, and Barriers to effective listening

- Students will improve their language skills in reading, writing, and expressing ideas clearly.

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UNIT2: A Birthday Letter by Jawaharlal Nehru (6 hours)

Reading-Skimming and Scanning

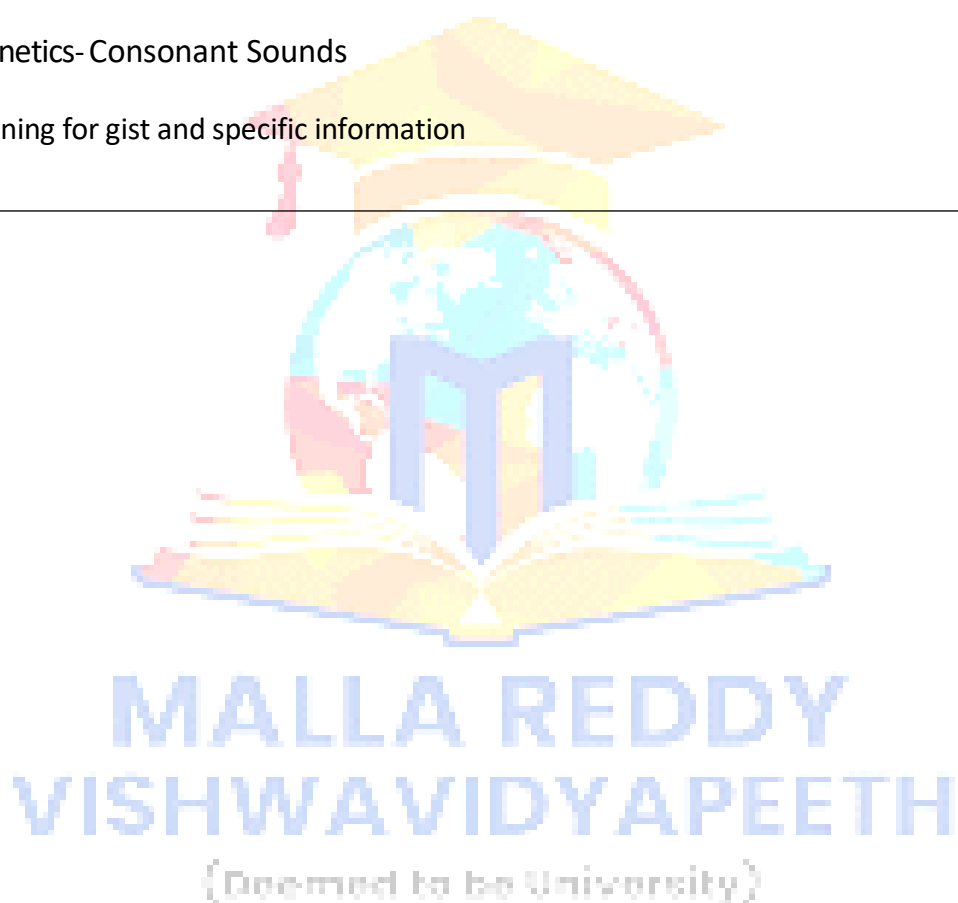
Writing-Letter writing (Requests, Leave applications, Purchase letters,
Letters in correspondence with medical insurance companies)

Grammar- Phrase, Clause and Sentence; Prepositions

ELCSLAB

CALLLAB: Phonetics- Consonant Sounds

Listening-Listening for gist and specific information



UNIT3: The secret of work by Swami Vivekananda (6 hours)

Reading-Making inferences and predictions

Writing-E-mail writing

Grammar-Tenses, Reported speech vocabulary–food and life style, instrument & equipment

ELCSLAB

CALLLAB: Intonation

Listening- Listening and identifying facts and opinions

ICSLAB: Speaking-Role Plays (OET) (Giving and taking instructions, Interacting with and explaining processes, conditions and instructions to the patients and their attenders,

UNIT4: All the world's a stage (Poem) by William Shakespeare (6 hours)

Reading-Reading for explicit and implicit meaning

Writing-Short essays: 2-Paragraph Essay, Thesis Statement

Grammar-Subject-Verbal agreement, Degrees of Comparison

ELCSLAB

CALLLAB: Consonant Clusters

Listening-Listen-Comprehend- Speak, Health Care

UNIT5: Sister Nivedita: Calcutta's Angel of Mercy (Article/Essay) by Monidipa Dey (6 hours)

Writing-Report writing (Analysing tests and Reporting patient condition) Grammar– Voice, If conditionals

Vocabulary-Health, Wellness, Medical Vocabulary/Terminology

ELCSLAB

CALLLAB: Past Tense Markers and Plural Markers

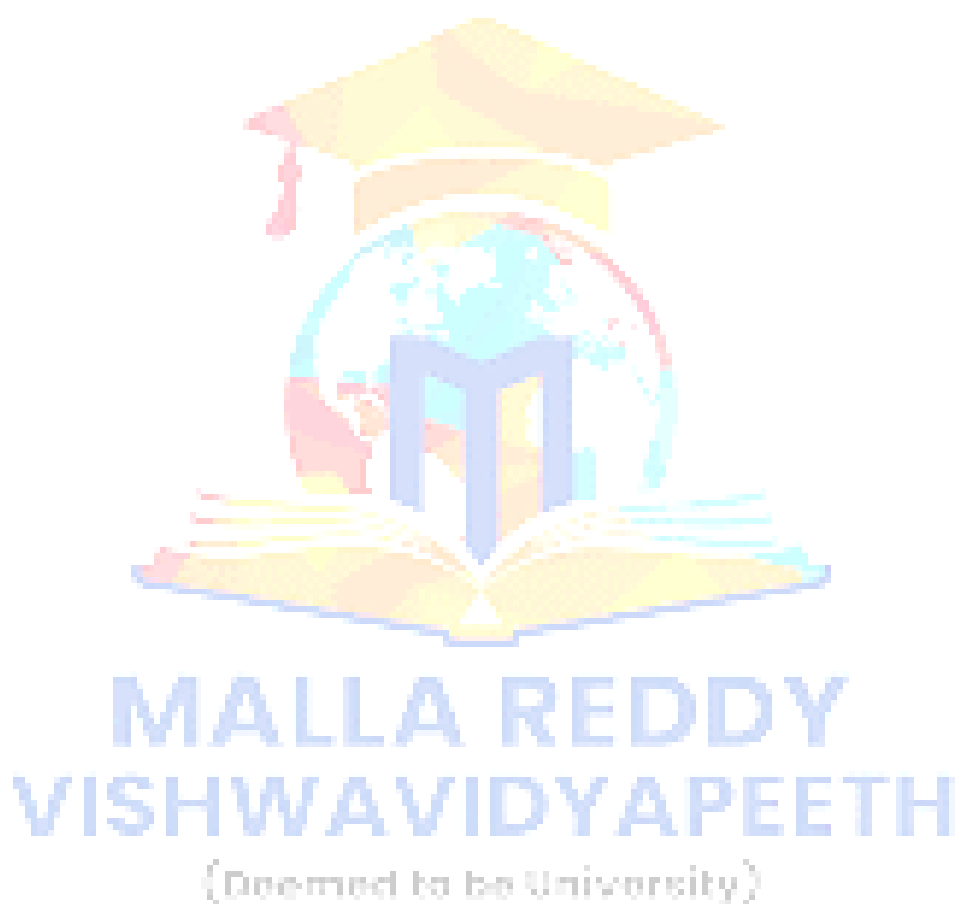
Listening- Listening tasks from OET and IELTS

TEXTBOOK:

English for Nurses by Vijaya Laxmi Naidu. Nirali Prakashan. 2008.

RECOMMENDED TEXT BOOKS

Practical English Usage by Michael Swan. OUP. 1995. On Writing Well by William Zinsser, Harper Resource Book. 2001. Cambridge English for Nursing by Virginia Allum and Patricia McGarr. CUP. 2010. English for Nursing by Ross Wright and Bethany Cagnol. Pearson. 2001. English for Nursing- 2 by Maris Spada Symonds and Ross Wright. Pearson. 2001. Every day English for International nurses by Joy Parkinson and Chris Brooker. Elsevier. 2004. Oxford English for Career Nurses by Tony Grice. Oxford University Press. 2007.



BASICS OF COMPUTERS**L/T/P/C 1/-/2/2****Learning Objectives:**

- To understand all components of a computer, different working environments, and computer operations.
- To learn how to create different types of Word documents, MS Excel manipulations, and PowerPoint documents.
- To understand basic requirements of computer network hardware, software, and its network architecture.

Learning Objectives:

- At the end of the course, the student will be able
- To understand peripheral of the computer how it works and understand various languages of the computer.
- To create any kind of presentations for presenting their knowledge anywhere in the form of a document or PPT.
- To create Excel sheets to save data and process the data efficiently.
- To understand basic requirements of computer network hardware, software, and its network architecture.

UNIT-I (3 hours)

Introduction to computers--Definition of Computer-Characteristics of Computer Components of Computer Hardware--Memories--RAM and ROM--MB, GB, their conversions -- Software: Application Software and Systems software- Data and Information --Different computer languages- Number systems- Binary and decimal conversions.

UNIT-II (3 hours)

MS Word: Typing text in MS Word--Manipulating text-- text--formatting text--using different font sizes, bold, italic-- bullets and numbering --Pictures, Aligning the text and justify-- choosing paper size-- adjusting margins-- header and footer, inserting page numbers in a doc-- printing a file with options--using spell check and grammar--find and replace-- mail merge-- insert tables in a document.

UNIT-III (3 hours)

MSEXCEL: Creating MS Excel -- Cell editing, using formulas and functions, manipulating data with Excel--using sort function to sort numbers and alphabets--drawing graphs and charts using data in Excel.

MSPowerPoint: Slide transition and animation-slides with sounds--inserting clip arts-- Pictures, tables, and graphs.

UNIT-IV (3 hours)

Introduction to Computer Networks: Introduction, Computer Network Devices(Hubs, Switches, Routers, Gateway, Bridge, Modems, Wireless Access Points, Firewalls & NIC), Types of computer Networks (LAN, MAN&WAN), Network Topologies(Star, Ring, Mesh, Tree, Hybrid Topologies), Internet Based Applications, Advantages & Disadvantages of Computer Networks, E-Mail, Components of E-Mail, Attaching Files in E-mail, Different

UNIT-V (3 hours)

Introduction to Artificial Intelligence & ML: History of AI, Sub Areas of AI, Applications of Healthcare, Benefits of AI in Healthcare, Challenges of AI in Healthcare, Introduction to Machine Learning, Applications of Machine Learning, Machine Learning Algorithms, Real-world Machine Learning Use Cases.

RECOMMENDED TEXT BOOKS

Computer Fundamentals by Goel, Anita Pearson

Computer Fundamentals: Concepts, Systems & Applications-8th Edition by Priti Sinha, Pradeep K., Sinha

MS-Office 2010 Training Guide by Prof. Satish Jain, M. Geetha, Computer Networks, Andrews Stanenbaum, 5th Edition, Pearson Education

Artificial Intelligence: A Modern Approach, Stuart J. Russell and Peter Norvig, Third Edition, Pearson Education

Hands-on Machine Learning with Scikit-Learn, Keras, and Tensor Flow, Aurelien Geron-O'Reilly, 2nd Edition.

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HUMAN ANATOMY- I (Practical)**L/T/P/C****-/-/4/2****Learning Objectives (LOs)**

- To understand the structure and identification of upper extremity bones, joints, muscles, vessels, and nerves.
- To develop skills in recognizing gross anatomical specimens and spotters of major organs and systems.
- To correlate anatomical structures with their functional and clinical significance.

Learning Outcomes (COs)

- Students will be able to identify bones, joints, vessels, nerves, and organs in gross specimens and spotters accurately.
- Students will demonstrate knowledge of surface anatomy and anatomical relationships of upper extremity and vital organs.
- Students will apply anatomical knowledge to understand basic clinical conditions and diagnostic procedures.

GROSS SPECIMENS/SPOTTERS (30 hours)**Upper Extremity**

- Identify the spotter- (Cross section of shoulder Joint, Elbow Joint, Wrist complex, Hand)
- Identify the bone- UPPER EXTREMITY BONES (Scapula, Clavicle, Humerus, Radius and Ulna, Carpals, Metacarpals and Phalanges) Including side determination
- Surface Anatomy of the Upper Extremity – UPPER EXTREMITY BONES AND MUSCLES
- Spotters of Blood vessels (Profunda Brachii, Brachial, Radial, Ulnar)
- Spotter of Nerves (Axillary, Musculocutaneous, Radial, Median, Ulnar)
- Gross Specimen of Heart, Lung
- Spotters of Bronchial tree, Bronchopulmonary segments

SYSTEMIC ANATOMY

- Gross Specimen/Spotter (Stomach, Liver, Gall Bladder, Spleen, Pancreas, Intestines, Kidney, Uterus)
- Cross section of Kidney

HUMAN PHYSIOLOGY–I Practical (30 hours)**L/T/P/C****-/-/4/2****Learning Objectives (LOs)**

- To understand basic physiological parameters and their importance in clinical assessment.
- To develop practical skills in performing routine physiological experiments and measurements.
- To correlate physiological findings with normal body functions and health status.

Learning Outcomes (COs)

- Students will be able to perform and interpret basic physiological tests such as blood grouping, haemoglobin estimation, and blood pressure measurement.
- Students will demonstrate skills in assessing vital signs including pulse, respiration, and auscultation of heart and lung sounds.
- Students will apply physiological knowledge to evaluate normal and abnormal clinical conditions.

These practical's typically align with the theoretical aspects of physiology and help students apply concepts to real-world clinical scenarios. Key Areas Covered in Human Physiology for this semester include the following:

- Determination of blood group, bleeding time and clotting time
- Estimation of hemoglobin concentration
- Peripheral pulse determination
- Auscultation of Heart sounds
- Determination of blood pressure
- Auscultation of breath sounds
- Assessment of respiratory rate

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ENVIRONMENTAL AWARENESS**L/T/P/C****1/-/-/1****Learning Objectives**

- To understand fundamental environmental concepts such as ecosystems, biodiversity, pollution, and climate change.
- To create awareness about environmental issues, resource conservation, and sustainable development.
- To encourage responsible behavior and participation in environmental protection and sustainability

practices.

Learning Outcomes

- Students will be able to explain key environmental concepts, issues, and their impact on ecosystems and human life.
- Students will analyze environmental challenges like pollution, climate change, and resource depletion, and suggest solutions.
- Students will adopt eco-friendly practices and contribute to environmental conservation at individual and community levels.

UNIT I (1 hour)

1. Introduction to Environmental Awareness
2. What is environmental awareness?
3. The importance of environmental education.
4. Key environmental concepts: ecosystems, biodiversity, sustainability. Historical perspective on environmental awareness.

UNIT II (1 hour)

1. Earth's Ecosystems and Biodiversity
2. What are ecosystems?
3. Types of ecosystems: forests, oceans, wetlands, etc. Importance of biodiversity.
4. Threats to biodiversity: habitat loss, invasive species, climate change.

UNIT III (2 hour)

1. Pollution and Its Impact
2. Types of pollution: air, water, soil, noise, and light pollution. Causes and effects of pollution on health and ecosystems. Case studies of major pollution events.

UNIT-IV (2 hour)

1. Climate Change and Global Warming
2. The science of climate change.
3. Greenhouse effect and human contributions.
4. Impacts of climate change: rising temperatures, sea levels, extreme weather. Mitigation and adaptation strategies.

UNIT-V (1 hour)

1. Resource Conservation
2. Renewable vs. non-renewable resources.
3. The importance of conserving water, energy, and other resources.
4. Techniques for conservation: recycling, energy efficiency, and water-saving practices.

UNIT-VI (1 hour)

1. Sustainable Agriculture and Food Systems
2. Environmental impact of conventional farming practices.
3. Sustainable agriculture: organic farming, permaculture, and agroecology. The role of diet in environmental sustainability.

UNIT-VII (1 hour)

1. Waste Management
2. Types of waste: municipal, industrial, hazardous, electronic. The 3 Rs: Reduce, Reuse, Recycle.
3. Landfills, incineration, and composting. Zero waste lifestyle.

UNIT-VIII (2 hour)

1. Water Conservation and Management
2. The global water crisis: causes and consequences. Water management practices and policies.
3. The importance of clean water for all living organisms.

UNIT-IX (2 hour)

1. Environmental Policy and Legislation
2. Global environmental treaties: Paris Agreement, Kyoto Protocol. National environmental policies and regulations.
3. Role of NGOs, governments, and individuals in policy development.

UNITX (2 hour)

1. Green Technologies and Innovations
2. Introduction to renewable energy sources (solar, wind, hydro, etc.). Electric vehicles and sustainable transportation.
3. Innovations in waste-to-energy and sustainable agriculture.
4. The Role of Individuals in Environmental Protection
5. How individual actions impact the environment.
6. Eco-friendly lifestyles: reducing waste, sustainable consumption, green travel. Community action and grassroots movements.

Reference Textbook

Environmental Science: A Global Concern" by William P. Cunningham & Mary Ann Cunningham

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Semester- IIHUMAN ANATOMY – II

L/T/P/C

4/-/-/4

COURSE DESCRIPTION:

The focus of this course is an in-depth study and analysis of the regional and systemic organization of the body. Emphasis is placed upon structure and function of human movement. A comprehensive study of human anatomy with emphasis on the nervous, musculoskeletal and circulatory systems is incorporated. Introduction to general anatomy lays the foundation of the course. Dissection and identification of structures in the cadaver supplemented with the study of charts, models, prosected material and radiographs are utilized to identify anatomical landmarks and configurations.

Objectives:

At the end of the course, the student will be able to

- Identify & describe Anatomical aspects of muscles, bones, joints, their attachments & to understand and analyze movements.
- Apply the knowledge of anatomy on the living (living anatomy).
- Identify and describe the course of peripheral nerves and blood vessels
- Obtain Knowledge of other systems & sensory organs

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SYLLABUS**UNIT-II****LOWER EXTREMITY:**

1. Arthrology: Joint structure, articulating components, relations, joint actions, Clinical and Applied Anatomy including Radiography
2. Hip Joint, Knee joint, Ankle joint, joints of the foot.
3. Femoral triangle, femoral canal and inguinal canal, Adductor canal, popliteal fossa, arches of foot
4. Lumbar plexus, Sacral plexus, Nerves of the Lower Extremity including cutaneous Nerves
5. Blood vessels and lymphatic drainage

UNIT-III**VERTEBRAL COLUMN AND PELVIC GIRDLE:**

1. Atypical and typical vertebra
2. Structure and features of Cervical, thoracic, lumbar, sacral and coccygeal vertebrae
3. Origin, insertion, nerve supply and actions of pre and para vertebral muscles
4. Muscles of Trunk and Abdomen
5. Core muscle Anatomy
6. Joints of vertebral column, structure and composition of intervertebral disc including the Radiography Evaluation
7. Joint structure, articulating components, relations, joint actions, Clinical and Applied Anatomy including Radiography of Sacro- Iliac joint
8. Structure of Innominate bone Pelvic girdle and muscles of the pelvic floor including Applied Anatomy

UNIT-IV**HEAD AND NECK:**

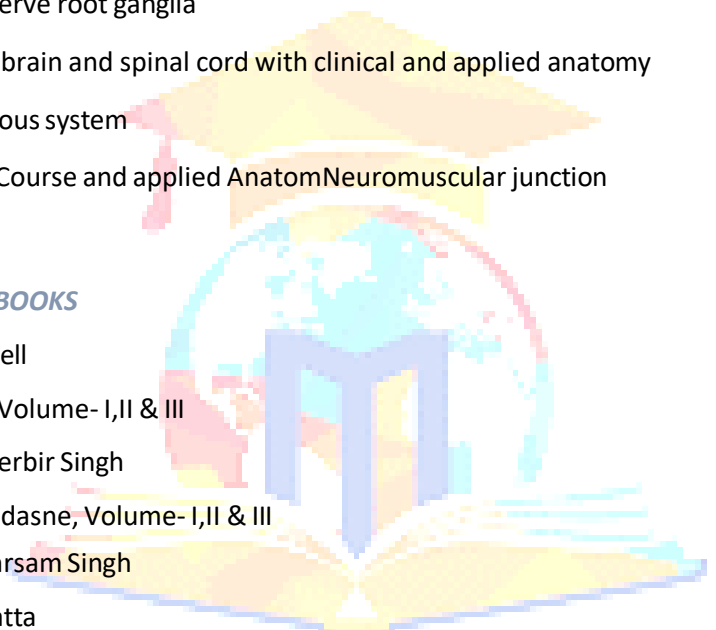
1. Bones of the skull and face
2. Muscles of the face and neck
3. Triangles of the neck
4. Gross anatomy of eyeball, nose, ears and tongue

UNIT-V**NEURO ANATOMY:**

1. General organization of Nervous System
2. Central Nervous System-Gross structure of Brain and Spinal Cord
3. Diencephalon- Gross structure of Thalamus, Hypothalamus and Basal Ganglia
4. Meninges and Coverings of spinal cord
5. Cerebro-Spinal Fluid and ventricles of brain
6. Spinal Cord- Segmental features, Laminae, Nuclei, Tracks of spinal cord
7. Spinal nerves, nerve root ganglia
8. Blood supply to brain and spinal cord with clinical and applied anatomy
9. Peripheral Nervous system
10. Cranial nerves- Course and applied AnatomNeuromuscular junction

RECOMMENDED TEXT BOOKS

1. Human Anatomy – Snell
2. Anatomy- Chaurasia, Volume- I,II & III
3. Neuro anatomy -- Inderbir Singh
4. Human Anatomy – Kadasne, Volume- I,II & III
5. Neuroanatomy -- Vishram Singh
6. Human Anatomy – Datta



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HUMAN PHYSIOLOGY-IIL/T/P/C
4/-/-/4**COURSE DESCRIPTION**

The course in Physiology over the first year is designed to give the student an in-depth knowledge of fundamental reactions in the human body. The major topics covered include the following: Nervous system, special senses, reproductive system, endocrine system, gastro-intestinal and excretory.

Objectives:

At the end of the course, the candidate will be able to

- Describe physiological functions of various systems, with special reference to nervous system
- Acquire the skill of basic clinical examination, with special emphasis to Peripheral & Central Nervous system, special senses.

SYLLABUS**UNIT-I****NERVOUS SYSTEM-I**

1. Introduction to nervous system - CNS, PNS and ANS
2. Neurotransmitters - Definition, fate of neurotransmitter, types
3. Synapse - Definition, type, structure, transmission of impulse across a synapse, properties.
4. Receptors and Sensation - Types of sensations, Classification of receptors, properties
5. Sensory System - Organization of the sensory system, sensory Homunculus
6. Ascending Tracts - Definitions, Neuronal composition of ascending tracts, dorsal column, anterolateral tract
7. Pathophysiology of pain - Definitions, hyperalgesia and allodynia, deep pain, referred

pain and its theories, management of chronic pain, endogenous opioid analgesic system

8. Motor Cortex - Cerebrum, cortical areas of brain, motor homunculus, cerebral dominance, connections, mapping the functional areas of brain
9. Descending Tracts - Pyramidal system, extrapyramidal system

UNIT-II

NERVOUS SYSTEM-II

1. Spinal cord - Introduction, effects of complete transection of the spinal cord, effects of hemisection of the spinal cord (Brown-Sequard Syndrome)
2. Reflexes - Reflex action, reflex arc, classification, properties, types - conditioned reflex, stretch reflex, inverse stretch reflex, withdrawal reflex, crossed extensor reflex, superficial reflexes (Plantar & Abdominal)
3. Connections, Functions and applied aspect of thalamus, hypothalamus, cerebellum, basal ganglia
4. Regulation of tone, Posture and its reflexes, Equilibrium and vestibular apparatus
5. Limbic system, Reticular Activating System, Sleep and its types, sleep disorders, Electroencephalogram (EEG)
6. Higher Functions - Learning, Memory, Speech
7. Autonomic Nervous System - Sympathetic division, Parasympathetic division, control of autonomic functions
8. Cerebrospinal fluid - Formation and circulation, composition and properties, functions, applied aspect - Hydrocephalus, lumbar puncture

UNIT-III

SPECIAL SENSES:

1. Vision - Anatomy of eye, visual pathway, pupillary reflexes, dark adaptation, light adaptation, photosensitivity
2. Hearing - Anatomy of ear, auditory pathway, tests for hearing - Watch test, Rinne's test, Weber's test, deafness, Audiometry
3. Taste and Smell: Taste sensations, taste pathway, olfactory pathway

ENDOCRINOLOGY:

1. Hormones - Definition, types, hormonal chemistry, regulation, hormone receptor, mechanism of action
2. Secretion, regulation, function and applied aspect of Hypothalamus, Pituitary Gland, Thyroid Gland, Parathyroid Gland, Pancreas, Adrenal Gland.

UNIT-IV**REPRODUCTIVE SYSTEM:**

1. Sex determination and differentiation & it's abnormalities, puberty, importance of sex hormones
2. Female reproductive system - Internal & external genital organs, Oogenesis, Structure of egg, Follicle development, ovulation, menstrual cycle, menopause
3. Male reproductive system - Testes, accessory sex organs, Spermatogenesis, structure of sperm
4. Physiology of pregnancy - Fertilization, Implantation, Placenta(formation, function, hormones), maternal changes during pregnancy, pregnancy tests, infertility
5. Childbirth Physiology - Parturition, Lactation

UNIT-V**GASTROINTESTINAL SYSTEM:**

1. Physiological stages of digestion
2. Liver function

EXCRETORY SYSTEM:

1. Kidneys-structure & function
2. Urine formation (to exclude concentration and dilution)
3. Juxtaglomerular apparatus
4. Fluid and electrolyte balance – Na, K, H₂O
5. Neural control of Micturition and diuresis
6. Applied physiology: Types of bladder'

RECOMMENDED TEXT BOOKS

1. Text book on Medical Physiology – Guyton
2. Textbook of Physiology – A K Jain



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HUMAN ANATOMY PRACTICAL – IIL/T/P/C
-/-/4/2**GROSS SPECIMENS/SPOTTERS****SPINE, PELVIS AND LOWER EXTREMITY**

7. Identify the **spotter**- Osteology- Identify the bone, LOWER EXTREMITY BONES (Iliac bone, femur, tibia, fibula, patella, tarsals, metatarsals and phalanges.) Including side determination, Spinal Segments, Vertebrae (Cervical, Thoracic, Lumbar, Sacral and Coccyx), Pelvis and Iliac Bones
8. **Surface Anatomy of the Spine and Lower Extremity** –Atlas, Axis, C-7 vertebrae, Spinous and Transverse process of vertebra, Locate the Iliac bone, ASIS and PSIS, Coccyx, Sacrum, Greater Trochanter, Condyles of femur, Patella, Tibial Tubercles and condyles, Shin Bone, Tarsal bones, Malleoli
9. Myology- (**cadaveric spotter**) Spotters of the lower extremity muscles including the origin, insertion, blood and nerve supply
10. Arthrology- (Cross section of Hip Joint, Knee Joint, Ankle Joint, Joints of Foot, Pelvic Joints, Joints of Spine, Intervertebral Joints, Facet Joints, Sacro-Iliac Joints)
11. Abdominal muscles, Pre and para vertebral muscles, pelvic floor muscles
12. Popliteal Fossa, Inguinal Canal, Arches of foot
13. Spotters of Blood vessels

NEURO-ANATOMY IDENTIFY**THE SPOTTER**

1. Cross Section of the Skull, Sinuses of skull,
2. Muscles of the skull and face
3. Triangles of the neck

SYSTEMIC ANATOMY

1. Gross Specimen/Spotter (Brain and Spinal Cord)
2. Cross section of brain and spinal cord
3. Identify the spinal nerves
4. Cranial Nerves

HUMAN PHYSIOLOGY PRACTICAL – II

L/T/P/C

-/-/2/1

1. Examination of superficial sensations
2. Examination of deep sensations
3. Examination of cortical sensations
4. Examination of reflexes
5. Cranial nerve examination
6. Examination of Balance and coordination

Basics of Radiation Physics

L/T/P/C

2/-/-/2

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.

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.

Electromagnetic waves: Introduction, Maxwell's equation, electromagnetic waves, energy density and intensity, momentum, electromagnetic spectrum and radiation in Atmosphere.

Electronics

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.

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.

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.

Heat

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).

Interaction of ionizing radiation with matter-Types of interactions of X-and gamma radiation, Photoelectric & Compton, Pair production, annihilation radiation.

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

Exponential attenuation (linear/mass attenuation coefficients), Half Value Thickness (HVT), Tenth Value Thickness (TVT), dependence on energy and atomic number.

Radiation intensity and exposure, photon flux and energy flux density. LET, range of energy relationship for alpha, beta particles with X-Rays.

Physical quantity, its unit and measurement: Fundamental and derived quantity, SI unit, various physical/radiation quantity used in Diagnostic Radiology and its unit (for example, KVp, mA, mAS, Heat unit

PRACTICALS/DEMONSTRATION

Basic concepts

Electricity and magnetism, Electromagnetic waves

Electronics

Discovery of x-rays-X-ray production and properties

Heat

Interaction of ionizing radiation with matter

Exponential attenuation, Physical quantity, its unit and measurement

Microbiology

L/T/P/C

3/-/-/3

a) Morphology-

3/-/-/3

Classification of microorganisms, size, shape and structure of bacteria. Use of microscope in the study of bacteria.

b) Growth and nutrition.

Nutrition, growth and multiplications of bacteria, use of culture media in diagnostic bacteriology.

c) Culture media.

Use of culture media in diagnostic bacteriology, antimicrobial sensitivity test.

d) Sterilization and Disinfection.

Principles and use of equipment of sterilization namely hot air oven, autoclave, and serum inspissate, pasteurization, antiseptic and disinfectants.

e) Immunology. -

Immunity, vaccines, types of vaccine and immunization schedule, principles, and interpretation of common serological tests namely Widell VDRL, ASLO, CRP, RF & ELISA.

Rapid tests for HIV and HBs Ag (excluding technical details).

f) Systematic Bacteriology.

Morphology, cultivation, diseases caused, laboratory diagnosis including specimen collection of the following bacteria (excluding classification, antigenic structure, and pathogenicity),

Staphylococci, Streptococci, Pneumococci, Gonococci, Meningococci, C. diphtheriae, Mycobacteria, Clostridia, Bacillus, Shigella, Salmonella E. coli, Klebsiella, Proteus,

Vibrio cholera Pseudomonas & Spirochetes.

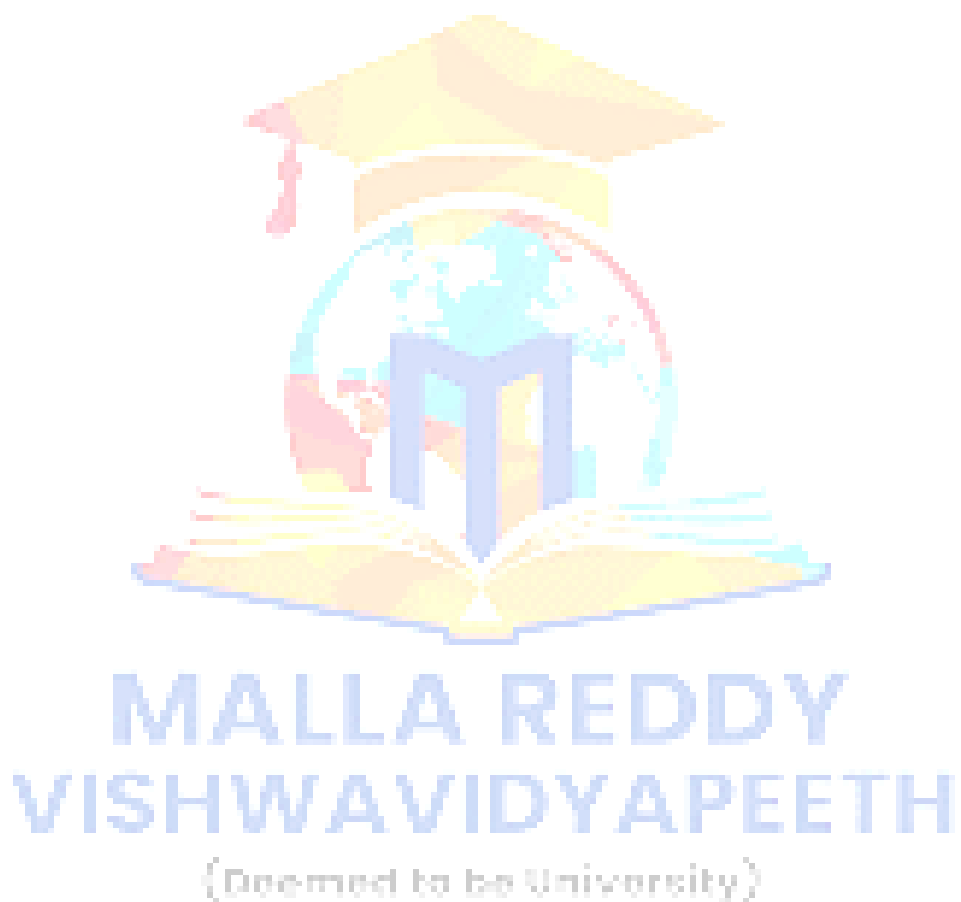
g) Parasitology.

Morphology, lifecycle, laboratory diagnosis of following parasites
E. histolytica Plasmodium, tapeworms, Intestinal nematodes

h) Mycology. -

Morphology, diseases caused and lab diagnosis of following fungi.

Candida, Cryptococcus, Dermatophytes, opportunistic fungi

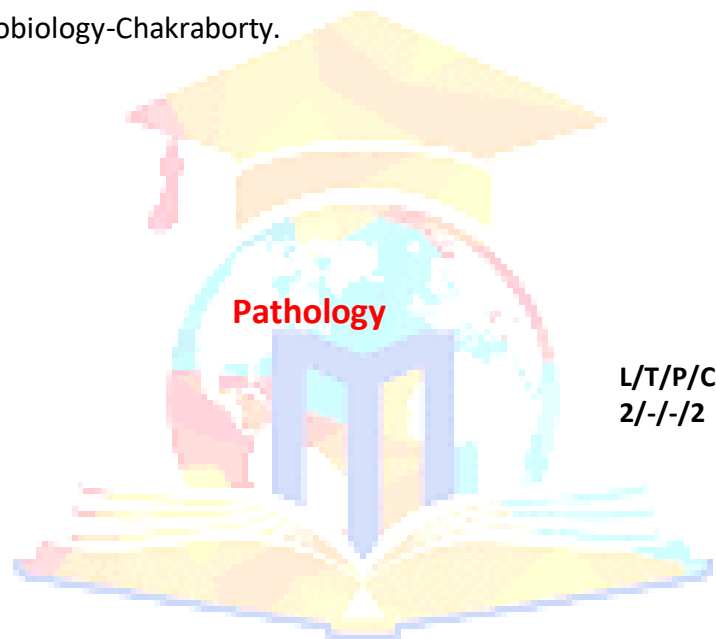


i)Virology -

General properties of viruses, diseases caused lab diagnosis and prevention of following viruses, Herpes, Hepatitis, HIV, Rabies and Poliomyelitis.

Reference:

- a. Microbiology, Anantha Narayan and Paniker's,
- b. CP. Baveja. Text book of Microbiology for nurses.
- c. A text book of Microbiology-Chakraborty.



L/T/P/C
2/-/-/2

UNIT:1**Cellular adaptation, Cell injury & cell death.**

- Introduction to pathology.
- Overview: Cellular response to stress and noxious stimuli. Cellular adaptations of growth and differentiation.
- Overview of cell injury and cell death.
- Causes of cell injury. Mechanisms of cell injury.
- Reversible and irreversible cell injury.
- Examples of cell injury and necrosis.

UNIT-II**Inflammation.**

- General features of inflammation Historical highlights

- Acute inflammation
- Chemical mediators of inflammation Outcomes of acute inflammation Morphologic patterns of acute inflammation Summary of acute inflammation
- Chronic inflammation

UNIT-III

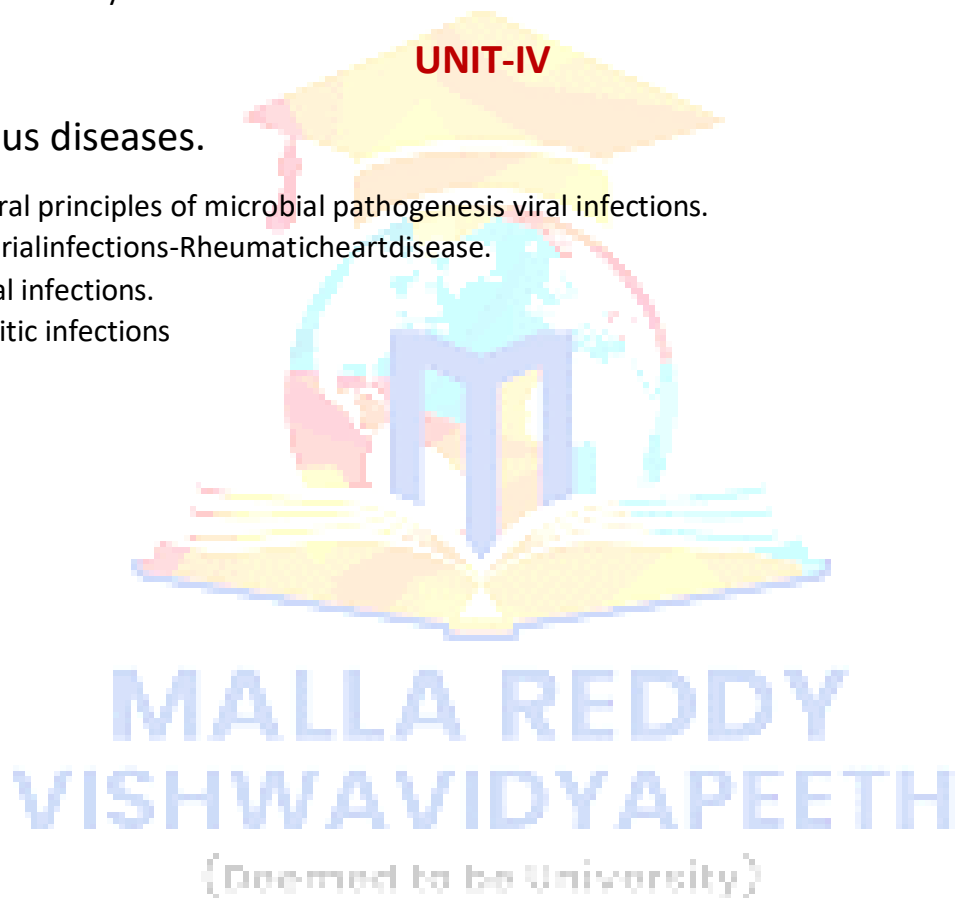
Immunity disorders.

- General features of the immune system Disorders of the immune system

UNIT-IV

Infectious diseases.

- General principles of microbial pathogenesis viral infections.
- Bacterial infections-Rheumatic heart disease.
- Fungal infections.
- Parasitic infections



UNIT-V**Neoplasia.**

- Definitions Nomenclature.
- Biology of tumor growth benign and malignant neoplasms Epidemiology.
- Carcinogenic agents and their cellular interactions Clinical features of tumors.

UNIT-VI**Environmental and nutritional disorders.**

- Environmental and disease.
- Common environmental and occupational exposures Nutrition and disease.
- Coronary artery disease.

RECOMMENDED BOOKS:

Pathology, Harsh Mohane. Basic Pathology by Robbins

Medical Terminology & Principals of Management

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L/T/P/C
1/-/-/1

Medical Terminology :

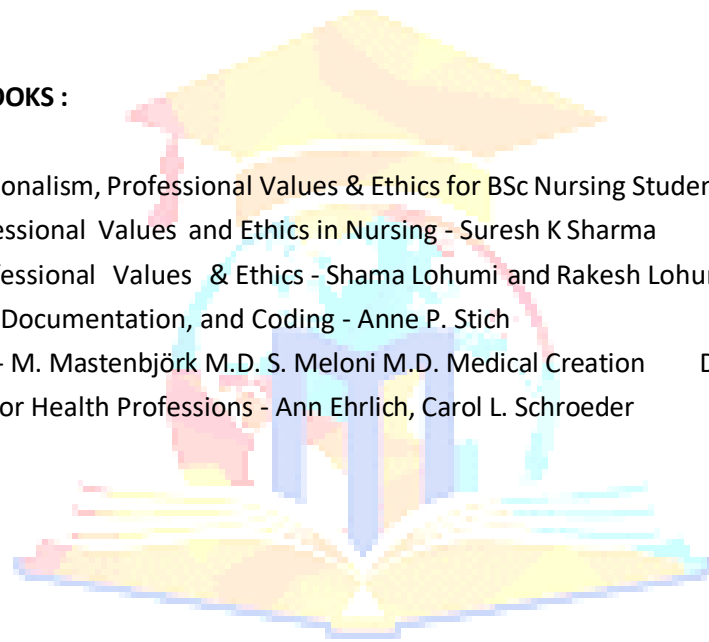
1. Derivation of medical terms.
2. Define word roots, prefixes, and suffixes.
3. Conventions for combined morphemes and the formation of plurals.
4. Basic medical terms.
5. Form medical terms utilizing roots, suffixes, prefixes, and combining roots.
6. Interpret basic medical abbreviations/symbols.
7. Utilize diagnostic, surgical, and procedural terms and abbreviations related to the integumentary system, musculoskeletal system, respiratory system, cardiovascular system, nervous system, and endocrine system.

Principals of Management :

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

REFERENCE TEXT BOOKS :

Essentials of Professionalism, Professional Values & Ethics for BSc Nursing Students - Varinder Kaur
Professionalism Professional Values and Ethics in Nursing - Suresh K Sharma
Professionalism, Professional Values & Ethics - Shama Lohumi and Rakesh Lohumi
Medical Terminology, Documentation, and Coding - Anne P. Stich
Medical Terminology - M. Mastenbjörk M.D. S. Meloni M.D. Medical Creation David Andersson
Medical Terminology for Health Professions - Ann Ehrlich, Carol L. Schroeder

**Clinical Radiography Positioning (Part I)**

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L/T/P/C
2/-/4/4

Principles of Radiography:

Preparation of the Room, Apparatus and Instruments Positions of the Patient: Erect, Sitting, Supine, Prone, Lateral, Oblique, Decubitus Etc. Relative position of X-Ray tube and patient, relevant exposure factors. Use of accessories such as radiographic cones, grid and positioning aids. Anatomic and Physiological basis of the procedure, Association with theory with practical work. Radiographic appearances, both normal and common abnormal conditions where elementary knowledge of the pathology involved will ensure the application of the appropriate radiographic technique. Modifications in technique for various disabilities and types of subject. Radiation protection, use of gonad shield, practical methods of reducing radiation dose to the patient.

Upper limb:

Routine projections for the whole hand, fingers, wrist joint, forearm, elbow joint and humerus.

Supplementary projections for Scaphoid, Carpal tunnel, Ball Catchers projections, Head of the Radius, Supracondylar fracture and Olecranon process

Lower limb:

Routine projections for the whole foot, toes, calcaneum, ankle joint, leg, knee- joint, patella and femurs.

Supplementary projections for Talo-Calcaneal joint, Forced projections for torn ligaments, Flat Feet, Club Feet, Intercondylar projections for loose bodies in the knee, Axial projection for Patella.

Shoulder Girdle and Thorax:

Routine projections for the shoulder joint, Scapula, Acromio-Clavicular joint, Clavicle, Sternoclavicular joint, Sternum and Ribs.

Supplementary projections for the axial projection of Clavicle, Bicipital groove, Coracoid process.

Vertebral Column:

Routine projections for Atlanto -Occipital joint, cervical spine, Cervico- thoracic Junction, thoracic Spine, lumbar Spine, Lumbo Sacral Region, Sacrum and Coccyx.

Supplementary projections for the intervertebral foramina, posterior arch of Atlas, Flexion and Extension of Cervical Spine, Scoliosis and Kyphosis, Sacro Iliac Joint.

Skull:

Routine projections for cranium and facial bones;

Supplementary projections for trauma, Towne's method, Sellatursica, 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.

Pelvic girdle and hip region:

Routine projections for the whole pelvis, Sacro-Iliac joints, hip joint and Neck of Femur. Supplementary projections for the greater and lesser trochanters of Femur. Frog leg projection, Ischium, Symphysis Pubis, Ilium, Acetabulum and Congenital Dislocation of Hip, Arthrodesis.

Skeletal survey: Skeletal survey for metabolic bone disease, metastases, hormonal disorder, renal disorders

PRACTICALS :

Principles of Radiography

Upper limb

Lower limb

Shoulder Girdle and Thorax

Vertebral Column

Skull

Pelvic girdle and hip region, Skeletal survey

REFERENCE TEXT BOOKS :

Atlas of Radiographic Positioning and Radiological Procedures –

Philip W Ballinger, Eugene D. Frank

Clarks Positioning In Radiography - Ra Swallow, E Naylor

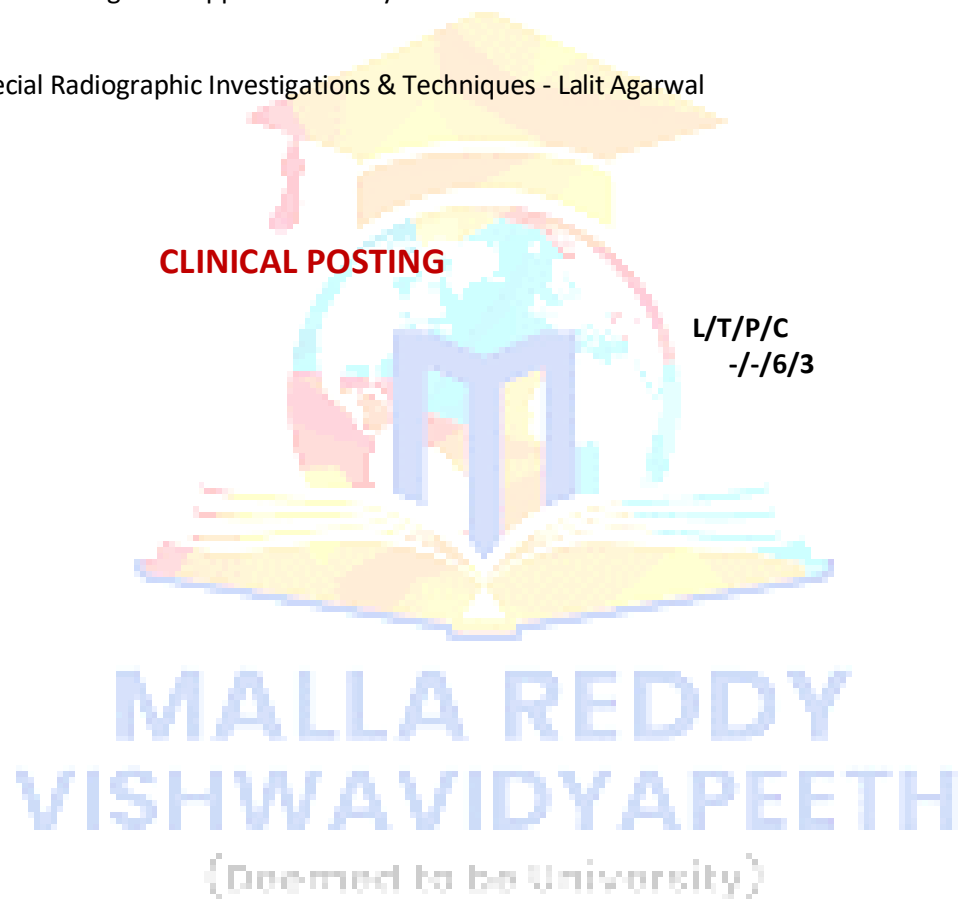
Merrill's Atlas of Radiographic Positioning and Procedures - Bruce W. Long & Jeannean Hall Rollins & Barbara J. Smith

Bontrager's Textbook Of Radiographic Positioning And Related Anatomy - John Lampignano and Leslie E Kendrick

Radiology Of Positioning And Applied Anatomy For Students And Practitioners –

Garkal Gs

A Guide on Special Radiographic Investigations & Techniques - Lalit Agarwal





SEMESTER-3

**MALLA REDDY
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(Deemed to be University)

SEMESTER-3**Subject: Pathology****Subject Code: BMRIT -015**

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
2	--	--	2	30	70	--	--	

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

III	Blood collection for investigations, anticoagulant. Sample collection, labeling, transportation to labs Common hematological tests – Peripheral blood smear, Haemoglobin, Packed cell volume, WBC count – variation of total and differential leukocyte count, Platelet count Bone marrow Aspiration and biopsy; Indications, procedure, contraindications and complications Anemias – Definition, classification, Iron deficiency anemia, causes, clinical features and lab diagnosis Megaloblastic anemia – cause, classification, diagnosis. Briefly hemolytic anemia Leukemia – Definition, classification, lab diagnosis of Acute Leukemias (AML & ALL) and Chronic Leukemias (CML & CLL) Bleeding disorders – Classification, Vascular, Platelet and coagulation factors contribution in clotting. Common Platelet disorders Common coagulation disorders (Hemophilia, DIC). BT, CT, Prothrombin time and APTT for diagnosis Blood grouping, cross matching, collection of blood from blood donors. Mandatory tests done in blood bank, blood components, complications of blood transfusion and its evaluation	7	15
IV	Osteomyelitis – Acute and chronic, Tubercular, causes, pathology & its complications Diseases of joints – Osteoarthritis and Rheumatoid arthritis – causes, aetiopathogenesis, pathology, complications Metabolic disease of bones – Osteoporosis, Osteomalacia, Rickets Cardiovascular diseases – Introduction, Atherosclerosis – definition, risk factors, sites/ organs, pathology manifestations, complications. Aneurysms – types, causes and complications Ischemic heart disease (IHD) – Types, Pathogenesis of Angina, Myocardial infarctions and its complications Rheumatic heart disease – etiology, pathogenesis and morphology of the heart Hypertension – definition, causes, complications Heart failure – Causes, pathophysiology, clinical manifestations and complications	7	15
V	Respiratory diseases – Chronic obstructive pulmonary airway diseases – causes, pathology and complications of	7	15

	each (asthma, chronic bronchitis, emphysema, Broncheictasis in brief). Pneumonia – classification, clinical features and morphology Pulmonary tuberculosis – classification/ types, primary, complex, miliary TB and cavitary 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		
Total		36	70

Sr.No		Hours
	- 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 - 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

Sr.No		Hours
	- Blood grouping, Transfusion complications, components. - Anemias – Microcytic hypochromic, Megaloblastic (slides) - Leukemia – AML & CML (Slides) - Atherosclerosis, MI, Rheumatic valvular lesions - Renal stones, hydronephrosis, chronic pyelonephritis (specimens) 18. Lung – Pneumonias, pulmonary tuberculosis cavitary lung abscess (specimens).	
	Total	6

SUGGESTED LEARNING RESOURCES

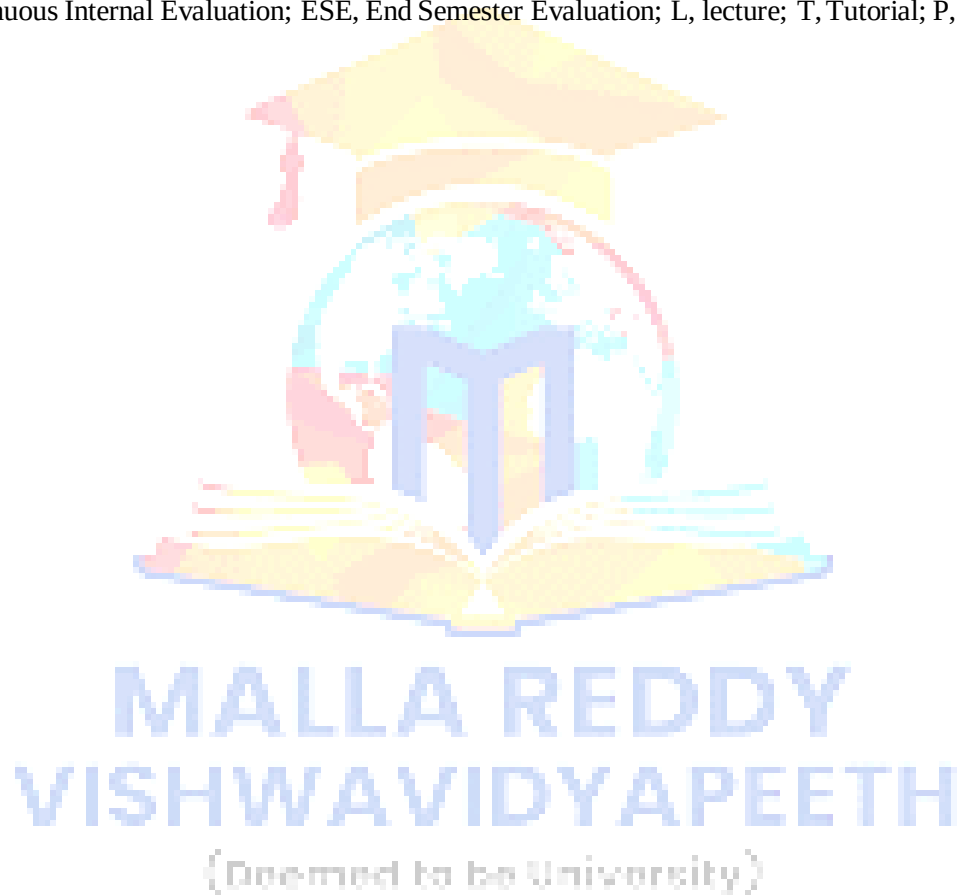
S.No.	Title of Book	Author	Publication
1	Textbook of Pathology with Pathology	Harsh Mohan	Jaypee Brothers Medical Publishers (P) Ltd
2	Pathology Basis of Disease	Robbins and Cotran	Saunders Elsevier
3	Text book on Pathology for DMLT & Paramedical Courses	Dr. I Clement	Emmess medical publishers
4	Text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

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Subject: Clinical Radiography Positioning (Part- II)**Subject Code: BMRIT - 016**

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	200
2	1	6	6	30	70	30	70	

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	Dental Radiography Technique for intra oral full mouth. - Occlusal projections. - Extra oral projections including orthopantomography. - Supplementary techniques. Upper respiratory system Technique for postnasal airways, larynx, trachea, thoracic inlet, Valsalva maneuver. - Phonation.	5	10
II	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. Abdominal viscera- Technique for plain film examination. - Projection for acute abdomen patients. - Technique to demonstrate: Foreign bodies, Imperforate anus.	6	10
III	Radiography using mobile X-ray equipment- Radiography in the ward: Radiography in the specialized unit, such as: Intensive care unit, Coronary care, Neonatal unit Radiography in the operating theatre. Mammography: Basic views, special views, wire localization. Localization of foreign bodies. Various techniques	5	10
IV	Ward/mobile radiography – electrical supply, radiation protection, equipment and instructions to be followed for portable/ward radiography. Operation theatre techniques: General precautions, Asepsis in techniques - Checking of mains supply and functions of equipment, selection of exposure factors, explosion risk, radiation protection and rapid processing techniques. Trauma radiography/Emergency radiography	5	10
V	Neonatal and Pediatric Radiography, Forensic Radiography Microradiography: General principles, Requirement, Equipment, Technique.	5	10

VI	Soft Tissue Radiography: High and low kilo voltage technique; differential filtration. Non - screen technique - simultaneous screen and non -screen technique. Multiple radiography. Uses of soft tissue radiography. High kV Radiography: General principles Relation to patient dose Change in radiographic contrast. Scatter elimination; beam collimation; grid ratio. Speed and type of grid movement. Radiographic factor; application and uses.	5	10
VII	Localization of foreign bodies: General location principles. Ingested; inhaled; inserted; embedded foreign bodies. Foreign bodies in eye. Preparation of the area to be investigated. Appropriate projection for all Techniques to locate non-opaque foreign body.	5	10
Total		36	70

Sr. No		Hours
1.	Dental Radiography; Upper respiratory system	20
2.	Lungs and Mediastinum; Abdominal viscera	20
3.	Radiography in the ward; Mammography	20
4.	Operation theatre techniques; C-arm	20
5.	Neonatal and Paediatric Radiography; Forensic Radiography Microradiography	10
6.	Soft Tissue Radiography Multiple radiography High kV Radiography Scatter elimination; beam collimation; grid ratio Speed and type of grid movement Radiographic factor; application and uses	10

Sr. No		Hours
7.	Localization of foreign bodies	8
	Total	108
6.	Soft Tissue Radiography Multiple radiography High kV Radiography Scatter elimination; beam collimation; grid ratio Speed and type of grid movement Radiographic factor; application and uses	14
7.	Localization of foreign bodies	12
	Total Marks (including optional questions)	96

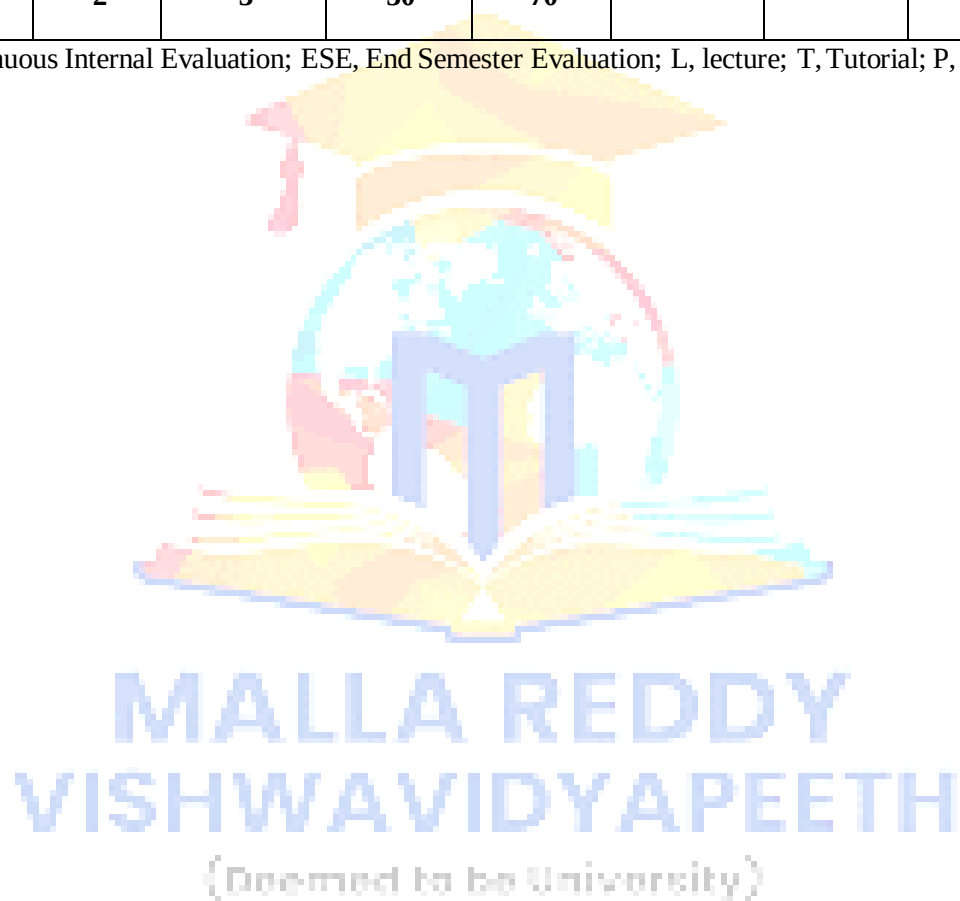
SUGGESTED LEARNING RESOURCES

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	GarkalGs	Jaypee Brothers Medical Publishers
4	Bontrager's Textbook of Radiographic Positioning and Related Anatomy	John Lampignano), Leslie E. Kendrick	Mosby
S.No.	Title of Book	Author	Publication
5	A Concise Guide on Basic Radiographic Physics Darkroom Procedures, Radiographic Positioning & Techniques	Lalit Agarwal	JBD Publications

Subject: Radiography and Image Processing Techniques**Subject Code: BMRIT -017**

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
2	--	2	3	30	70	--	--	

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.

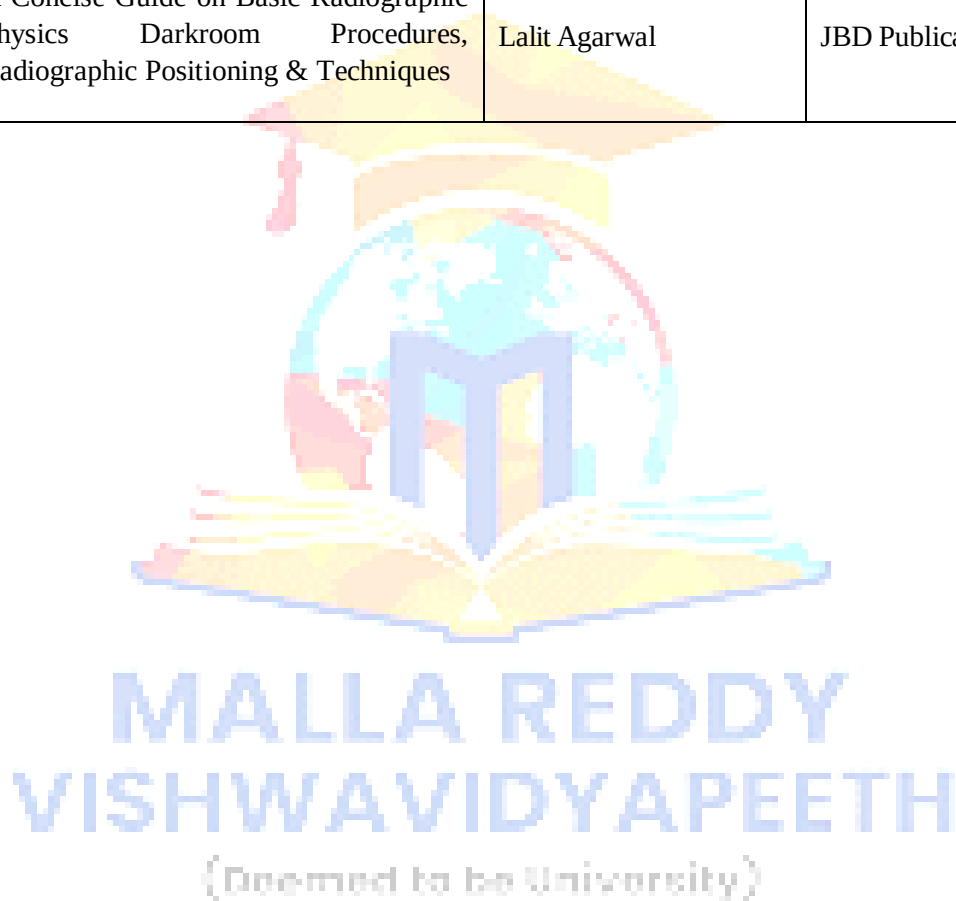
Unit	Topic and contents	Hours	Marks
I	Photographic Principles: Radiographic film- construction and types; Photographic effect and latent image formation; Film density and log relative exposure; Characteristic curve – its formation and features; Spectral response; Film faults and Artifacts Intensifying Screens: 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 X-ray Cassette: Construction of X-ray cassettes; Types of cassettes; Mounting Intensifying Screens on cassettes; Care and maintenance of cassettes	9	20
II	Dark Room – Planning & Construction: 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 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	7	15
III	Film Processing: Photochemistry; Developer; Rinsing; Fixer; Washing and drying; Preparation of processing solutions; Manual processing apparatus; Effect of temperature in processing; Rapid processing Automatic processor: Principle of working and features, thermal regulation and replenishment system; Care and maintenance of automatic processor; Advantages and limitations of automatic processor	7	15

IV	Day Light Film handling; Xeroradiography, Stereoscopy	5	5
V	The Radiographic Image: The emergent beam related to densities on film contrast – objective and subjective Radiation contrast, film contrast and Radiographic contrast- Density, Sharpness, Unsharpness Resolution: Factors affecting resolution, choice of Kilovolt age and Mill amperage, Choice of Short Focus and Broad Focus, selection of Focus to Film Distance and Object to Film Distance selection of cassettes, Avoiding scatter radiation, magnification, distortion, penumbra Reproduction of Radiographs: Copying Radiographs, Magnification and Minification Radiography Imaging Communication: Hospital Information System, Radiology Information System, PACS, DICOM	8	15
Total		36	70

Sr. No		Hours
1.	Radiographic film; Intensifying Screens; X-ray Cassette	20
2.	Dark Room – Planning & Construction	6
3.	Film Processing; Photochemistry;	5
4.	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	5
	Total	36

SUGGESTED LEARNING RESOURCES

S.No.	Title of Book	Author	Publication
1	Radiographic Imaging (Cbs)I.C.R.P.	D.N. Chesney & M.O Chesney	Blackwell Scientific
2	An Introduction Of Physics to Diagnostic Radiography	Christensen, Curry & Dowdey	Lea & Febiger
3	Radiological Science for technologists	Stewart C. Bushong	Mosby
4	A Concise Guide on Basic Radiographic Physics Darkroom Procedures, Radiographic Positioning & Techniques	Lalit Agarwal	JBD Publications



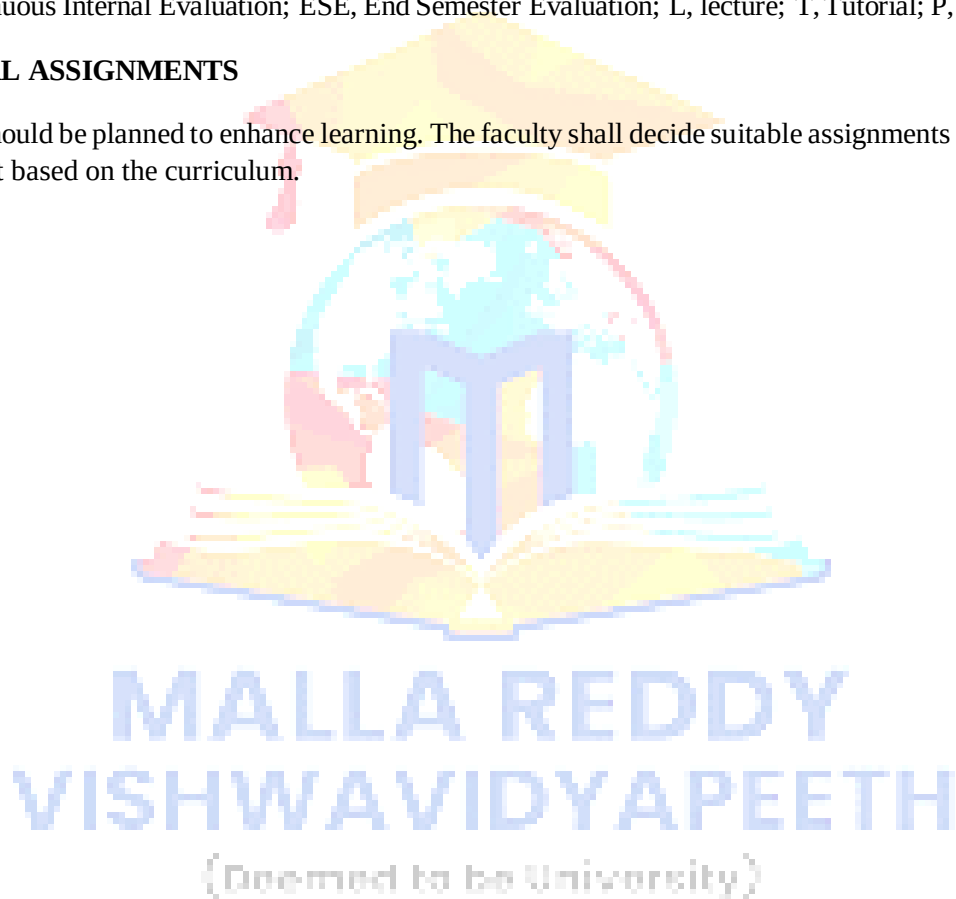
Subject: Contrast and Special Radiological Procedures**Subject Code: BMRIT - 018**

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	200
2	1	6	6	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.



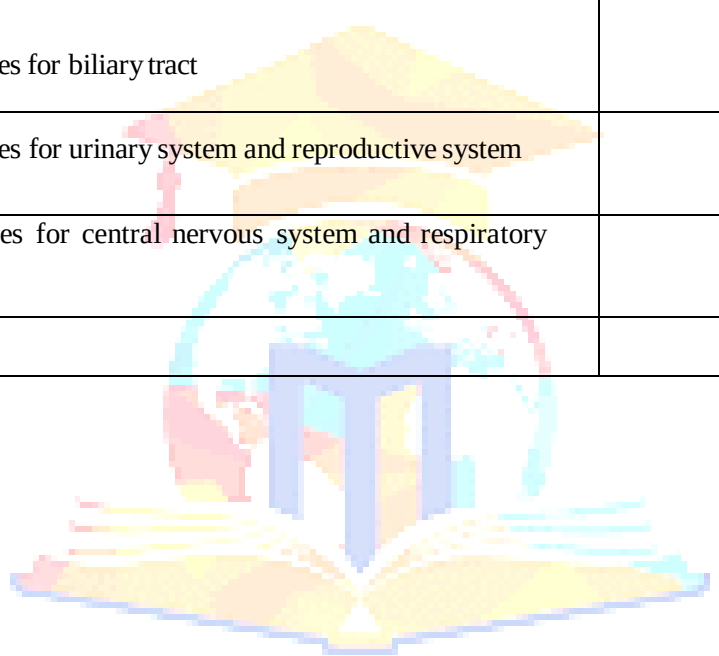
THEORY COMPONENTS

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

Unit	Topic and contents	Hours	Marks
I	Introduction: General approach to Special Radiographic procedures, Responsibility of Radiology Technologist during radiological procedures, Preparation of patient for different procedures, Room layout in interventional radiology and fluoroscopy. Contrast Media: Positive and Negative, Ionic & Non Ionic, Adverse Reactions to contrast media and patient management. Emergency Equipment in the Radiology Department	8	10
II	Gastro Intestinal Tract: Barium Swallow; Barium Meal - Single and Double Contrast; Barium Meal Follow Through; Small Bowel Enema (Enteroclysis); Barium Enema - Gastrografin Enema; Loopogram Biliary Tract: Oral & Intravenous Cholecystography; Percutaneous Transhepatic Cholangiography; Percutaneous Transhepatic Biliary Drainage; Endoscopic Retrograde Cholangiopancreatography	10	20
III	Urinary System: IVU (Intravenous Urography), Retrograde Pyeloureterography (RGU), Micturating Cysto Urethrography, Ascending Urethrography Reproductive System: HysteroSalpingogram, FTR (Fallopian Tube Recanalization)	8	20
IV	Central Nervous System: Cervical Myelography - Cisternal Puncture and Lateral Cervical Puncture, Lumbar Myelography, Myelography with water soluble and oily contrast media Respiratory System: Bronchography, Percutaneous Lung Biopsy Other procedures in radiology: Arthrography, Sialography, Lymphography, Sinography & Fistulography, Dacryocystography, Embolization & embolic agents	10	20
Total		36	70

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



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SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication
1	Radiographic Imaging (Cbs)I.C.R.P.	Bhushan and Lakkhar	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 semesters.
- Provide simulation and skill labs for practising 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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Fourth Semester

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Subject: Cross Sectional Anatomy

Subject Code: BMRIT - 019

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
2	--	6	5	--	--	30	70	

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	Introduction to Sectional Anatomy & Terminology- Sectional planes, Anatomical relationships/terminology Anatomy of the upper thorax-Surface anatomy relationships, Bony structures and muscles, Blood vessels.	12	--
	Divisions of the mid-thorax, heart and great vessels-Lungs, heart and great vessels, Esophagus		
II	CT/MRI Images of the Thorax - Normal and abnormal imaging Anatomy of the Abdomen- Major organs and their accessories, Abdominal blood vessels CT/MR Images of Abdomen – Normal and pathologic anatomy of the Pelvis- Bony structures and associated muscles, Digestive and urinary systems Reproductive Organs - Normal and abnormal imaging	12	--

III	CT/MR Images of the Male/Female Pelvis- Normal and pathologic Neuro Anatomy -Scan planes Brain –Cerebral hemispheres, Sinuses, Ventricles, Brainstem and associated parts, Arterial/venous systems, Basal ganglia, Cranial nerves Spine - Vertebra and disc, Spinal cord and meninges Neck -Arterial/venous systems, Muscles, Glands and pharynx	12	--
Total		36	--

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

	Total	108

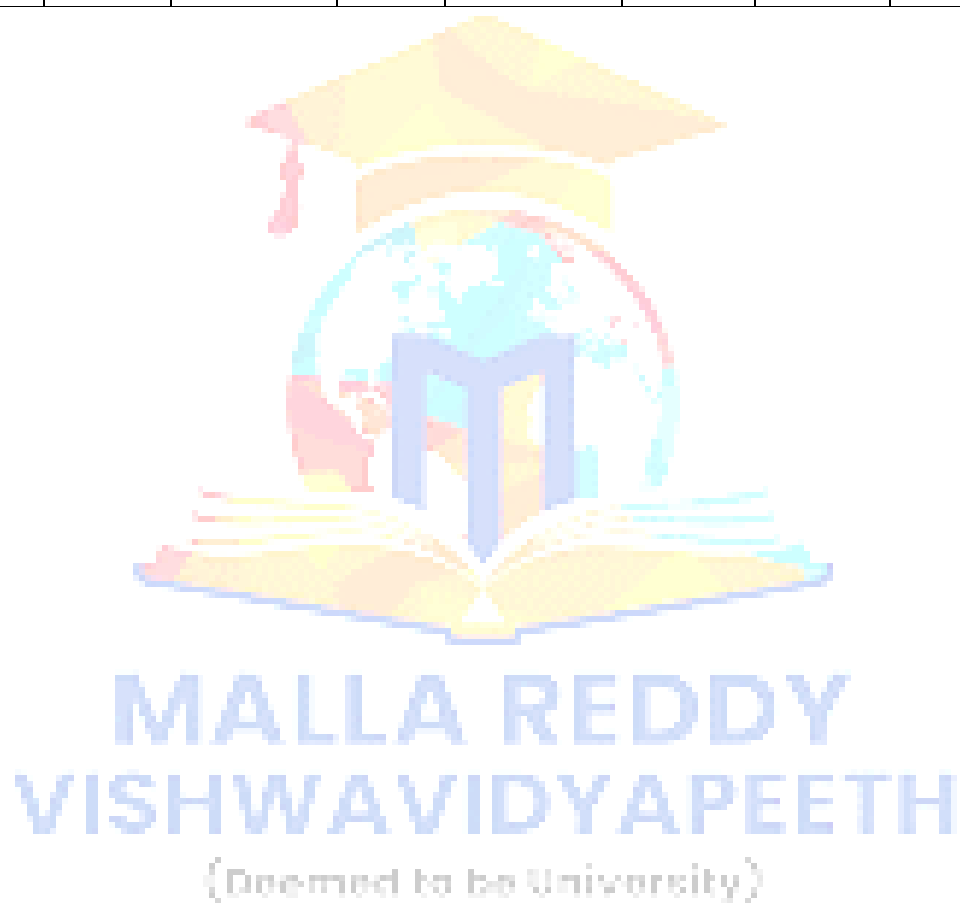
SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication
1	Cross Sectional Anatomy CT & MR	G Bhavin Jhankaria	Jaypee Brothers Medical Publishers;
2	Step by step Cross-sectional Anatomy	D Karthikeyan	Jaypee brother medical publishers
3	Atlas of Cross Sectional Anatomy and Radiological Imaging	Dr David J. Jackowe	Anshan Ltd
4	Fundamentals of Sectional Anatomy: An Imaging Approach	Denise L. Lazo	Cengage Learning

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Subject: Modern Radiological Imaging Equipment and Physics**Subject Code: BMRIT - 020**

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



THEORY COMPONENTS

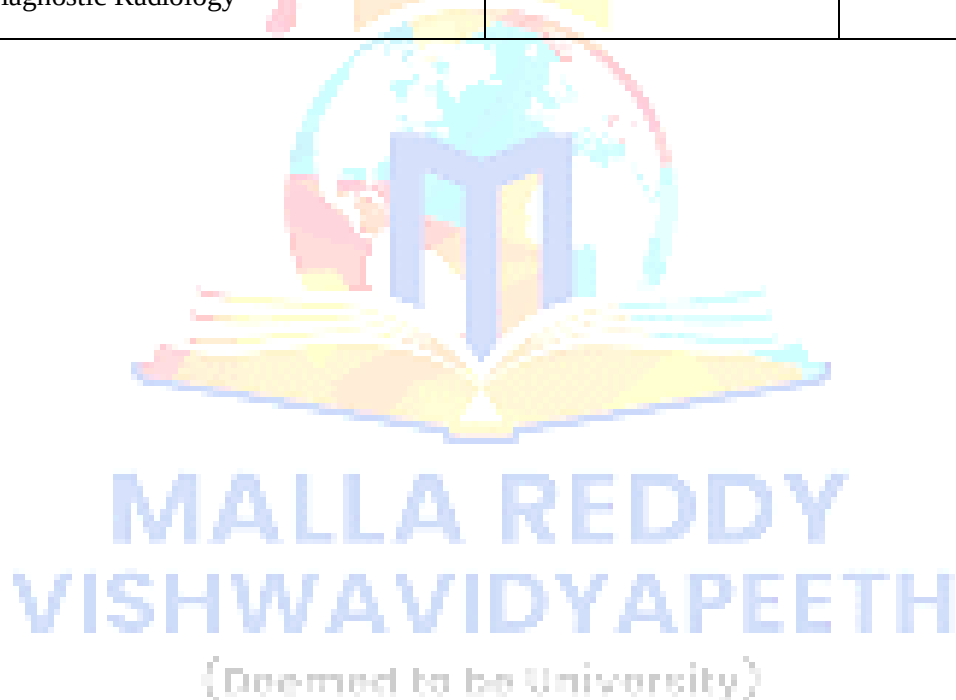
The following topics/subtopics should be taught and assessed in order to attain the identified competency.

Unit	Topic and contents	Hours	Marks
I	Modern x-ray tube. Digital Mammography and Tomosynthesis, Stich radiography, Dual energy x-ray absorptionmetry (DEXA) scan.	9	20
II	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.	9	20
III	Modern dental equipments. Cone beam dental CT.	9	20
IV	Picture archiving and communication system (PACS), RIS and HIS.	9	10
Total		36	70

Sr. No		Hours
1.	Modern x-ray tube. Digital Mammography and Tomosynthesis, Stich radiography, Dual energy x-ray absorptionmetry (DEXA) scan.	9
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.	9
3.	Modern dental equipments. Cone beam dental CT.	9
4.	Picture archiving and communication system (PACS), RIS and HIS.	9
Total		36

SUGGESTED LEARNING RESOURCES

S.No.	Title of Book	Author	Publication
1	Textbook of Radiology: Physics	Amol Sasane, Hariqbal Singh , Roshan Lodha	Jaypee Brothers Medical Publishers
2	The Physics Of Radiology And Imaging	THAYALAN K	Jaypee Brothers Medical Publishers
3	Christensen's Physics of Diagnostic Radiology	Thomas S. Curry, James E. Dowdey, Robert E. Murry	Lea & Febiger, U.S
4	Textbook Of Radiology For Residents And Technicians	BHARGAVA S. K (Author	CBS; publishers
5	Concise Text Book on Imaging Modalities & Recent Advances In Diagnostic Radiology	Lalit Agarwal, Dr. K.B. Gehlot	JBD Publications



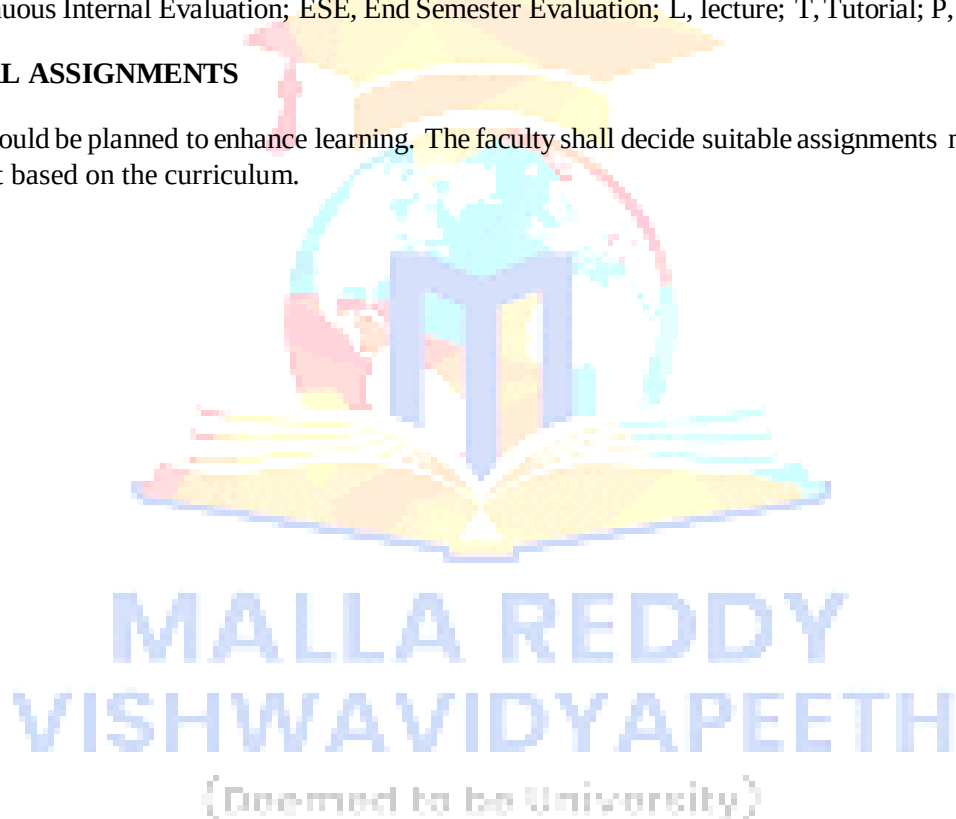
Subject: Interventional Radiology Techniques**Subject Code: BMRIT -021**

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	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.



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 to interventional procedures DSA: basic principles and types Equipment: Basics of angiographic equipment, single and biplane angiographic equipments, angiographic table, image intensifier, flat panel detectors, recording systems, pulse oximetry, cardiac resuscitation measure-ECG, pressure injector, catheters, needle and other tools, 3D rotational angiography, image processing, patient monitor, CO2 angiography	6	15
II	Interventional procedures: Catheter- classification, types and applications, Guide wire- classification, types and applications, Pressure Injector and Accessories, Percutaneous catheterization, Digital Subtraction Angiography, Catheterization Sites, Asepsis	9	20
III	Arteriography: Head and Neck Arteriography, Pulmonary Arteriography, Coronary Arteriography, Ascending Aortography, Trans Lumbar Aortography, Renal Arteriography, Trans Femoral Arteriography Venography: Peripheral Venography- Lower Limb, Upper Limb, Central Venography, Superior Venacavography, Inferior Venacavography, Pelvic Venography	9	20
IV	Safety considerations in angiography room; room design, protective devices, radiation monitoring	6	10
V	Care and maintenance tests: General care, functional test Quality assurance program: Acceptable limits of variation, corrective action	6	05
Total		36	70

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

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

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)

S. No.	Title of Book	Author	Publication
1	The practice of interventional radiology	Karim valji	
2	Interventional radiology: a survival guide	EBIR Kessel, David, Robertson, Iain	Elsevier Health Sciences
3	Handbook of Interventional Radiologic Procedures	Krishna kandarpa, lindsay machan, janettedurham	Lippincott Williams and Wilkins
4	Interventional Radiology: A Survival Guide	David Kessel , Iain Robertson	sevier Health Sciences
5	A Guide on Special Radiographic Investigations & Techniques	Lalit Agarwal	JBD Publications



B. MRIT Bachelor of Medical Radiology and Imaging Technology

Subject: Patient Care in radiology

Subject Code: BMRIT - 022

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	200
1	1	4	4	30	70	30	70	

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	Introduction to Patient Care: Responsibilities of Medical Imaging Technologist, Obtaining Consents and history for different radiological examinations, Patient transfer and Restraining techniques, Obtaining vital signs, Ergonomics and body mechanism Communication: Patient education, Communication with the patient, Professional role and behavior	2	10
II	Hospital procedure: Hospital staffing and organization; records relating to patients and departmental statistics; professional attitude of the technologist to patients and other members of the staff; medico- legal aspects; accidents in the departments, appointments, organization; minimizing waiting time; out-patient and follow-up clinics; stock-taking and stock keeping.	2	10
III	Care of the patient : FIRST contact with patients in the department; management of chair and stretcher patients and aids for this, management of the unconscious patient; elementary hygiene; personal cleanliness; hygiene in relation to patients.	3	10

IV	Nursing procedures in Radiology: Injection- methods and their routes of administration, Clothing of patient, Administering rectal enema. First aid: Aims and objectives of first aid; wounds and bleeding, dressing and bandages; pressure and splints, supports etc. Shock; insensibility; asphyxia; convulsions; resuscitation, use of suction apparatus, drug reactions; prophylactic measures; administration of oxygen; electric shock; burns; scalds; hemorrhage; pressure points; compression band. Fractures; splints, bandaging; dressing, foreign bodies; poisons.	3	10
V	Infection: Bacteria, their nature and appearance; spread of infections; auto-infection or cross-infection; the inflammatory process; local tissue reaction, general body reaction; ulceration; asepsis and antisepsis. Universal precautions, hospital acquired infections- HIV, Hepatitis B, C, and MRSA etc. Principles of asepsis: Sterilization - methods of sterilization; use of central sterile supply department; care of identification of instruments, surgical dressings in common use, including filamented swabs, elementary operating theatre procedure; setting of trays and trolleys in the radio imaging department (for study by radio imaging students only)	3	10
VI	Patient care in following investigations: GIT, Respiratory system, Cardiovascular system, CNS; Sterilization; Infection control 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.	2	10

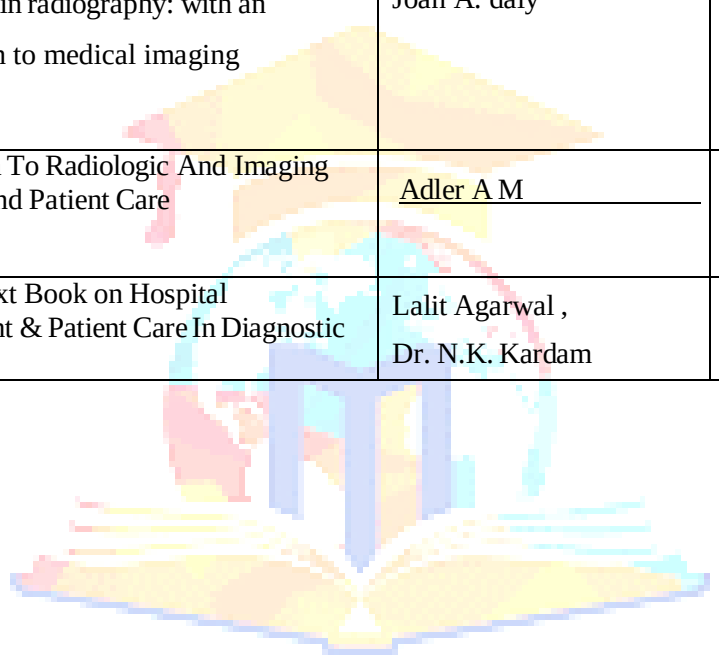
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VII	Drugs in the department and Storage: classification; labelling and checking, regulations regarding dangerous and other drugs; units of measurement, special drugs, anti-depressive, anti-hypertensive etc. crash cart. Medical ethics and records: Medico legal implication of MLC cases, Importance of consent, Consent in detail, Precaution while dealing with female patient, Medical records	3	10
Total		18	70

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

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	<u>Ruth Ann Ehrlich</u> 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



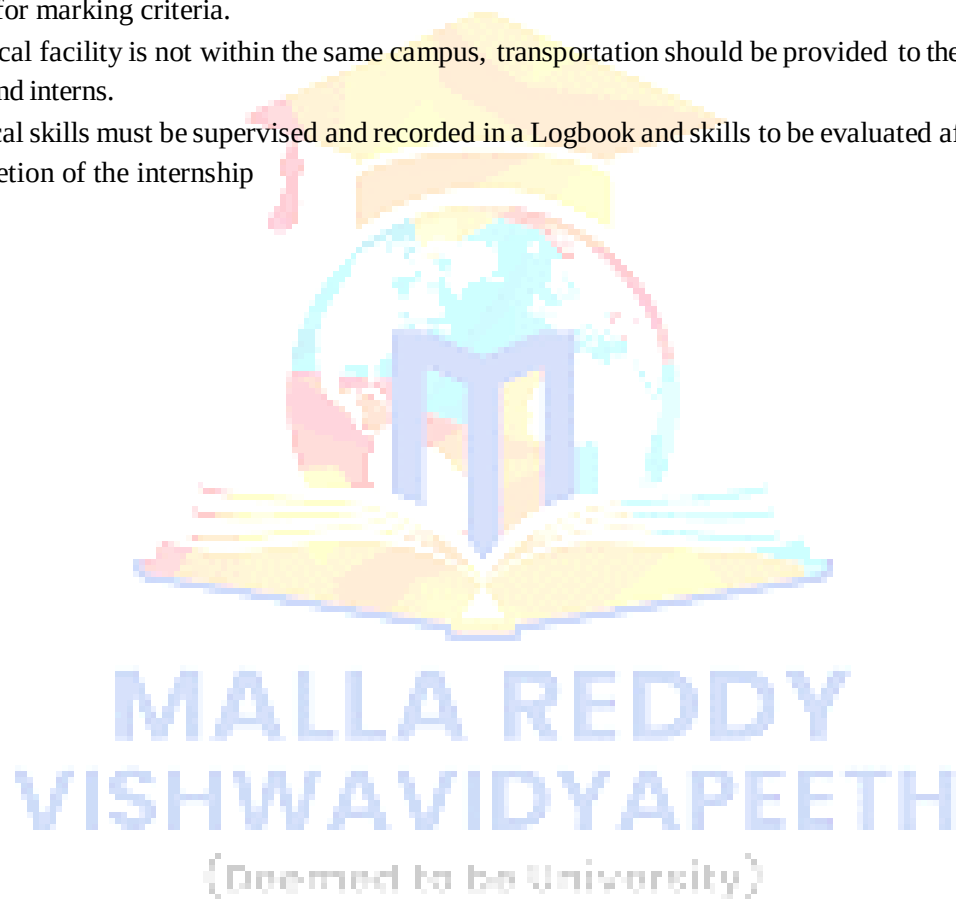
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BMRIT Radiology Clinical Education – part IV (studentship)

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 semesters.
- Provide simulation and skill labs for practising 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





Fifth Semester

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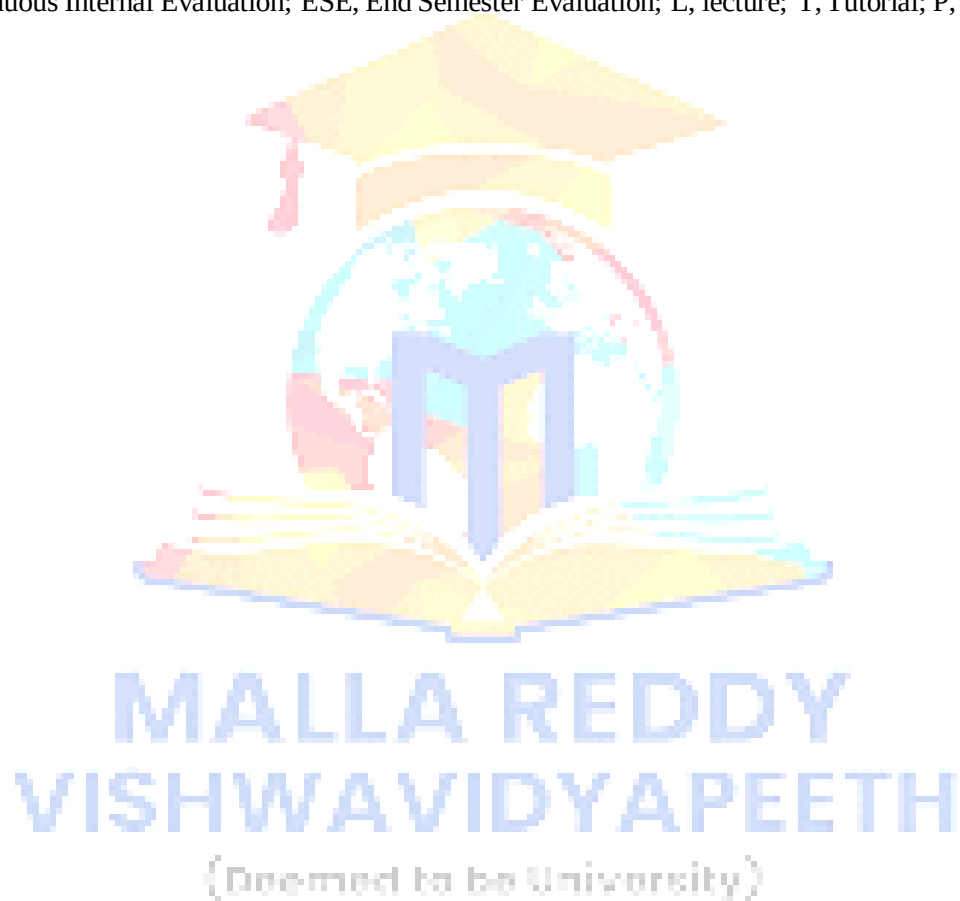
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Subject: Basics Techniques in CT Technology**SUBJECT CODE:0023**

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	200
4	1	8	9	30	70	30	70	

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



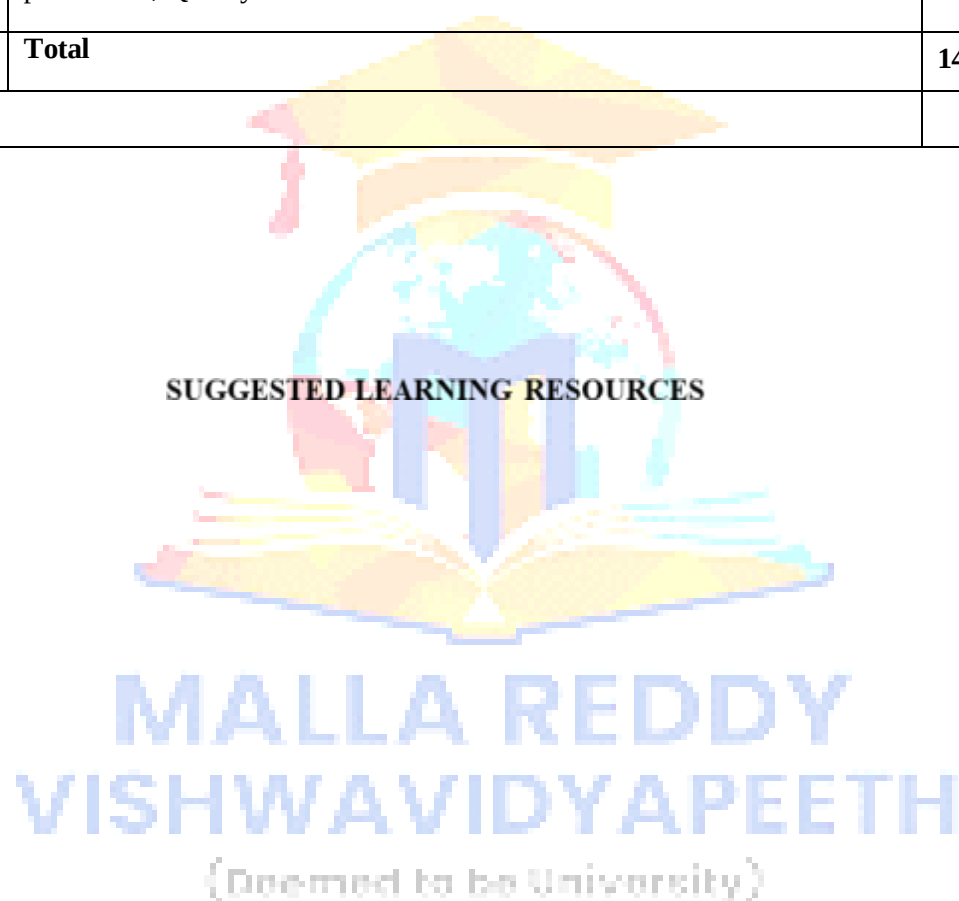
THEORY COMPONENTS

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

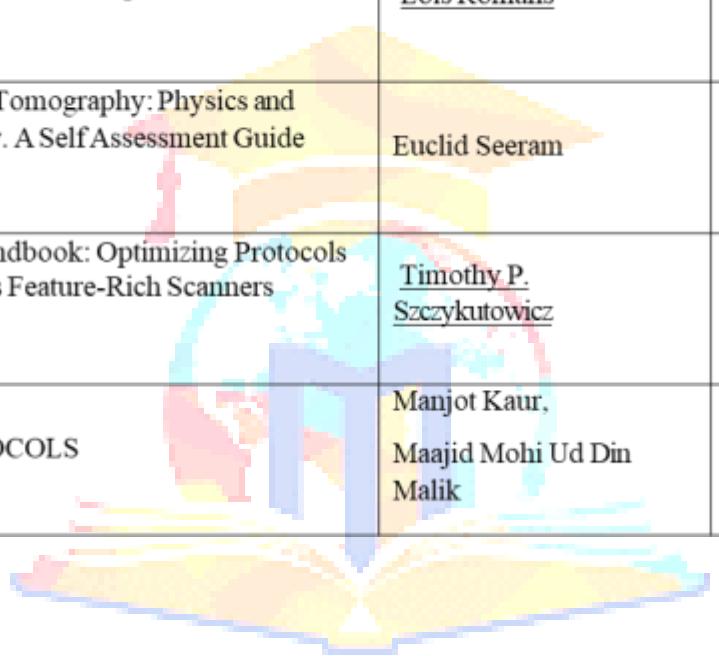
Unit	Topic and contents	Hours	Marks
I	Introduction and history, CT principle, CT generations, CT Instrumentation, CT detectors, Axial & Helical CT – Slip ring technology	15	20
II	Data acquisition, Image pre-processing/reconstruction techniques, Algorithms for image reconstruction, Image display, Image 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

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

Sr. No		Hours
3.	CT Protocols for different body parts & Dental scan, CT Protocols for Angiography & Perfusion, CT contrast media and administration, CT guided interventional procedures	54
4.	Multi-detector CT	20
5.	Safety consideration, Documentation in CT, Role of Medical Imaging technologist in CT scan procedures, Quality assurance in CT	20
	Total	144



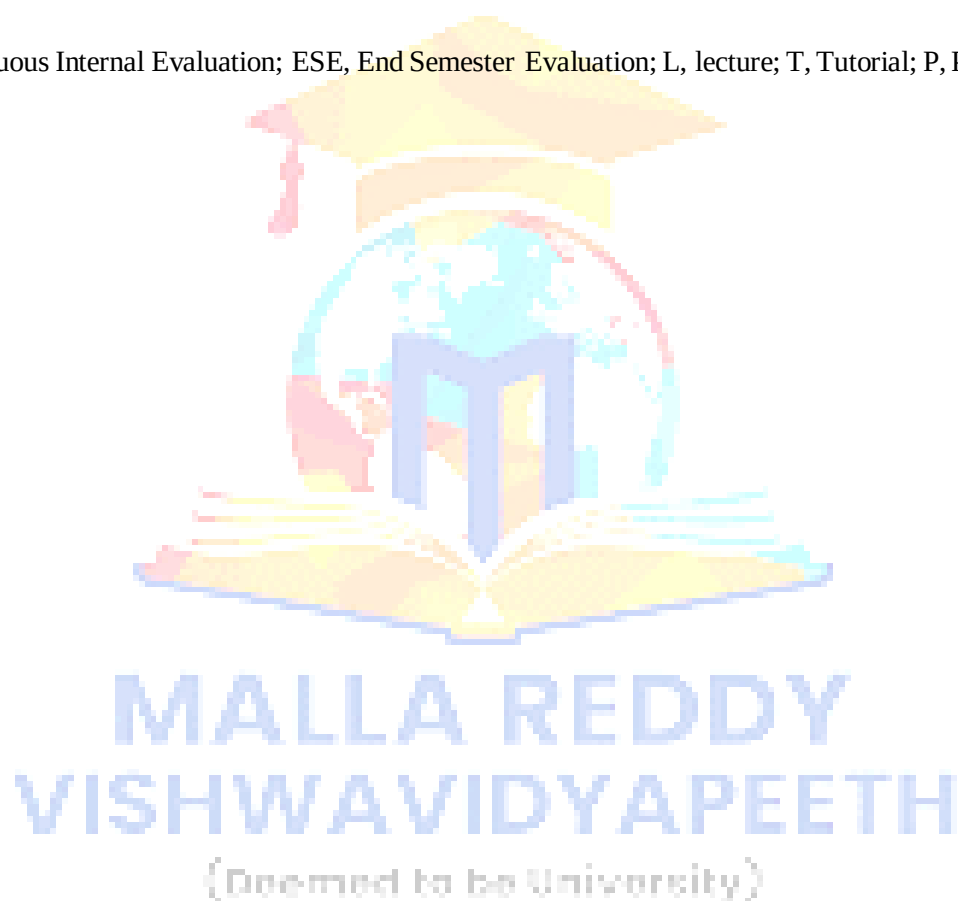
S. No.	Title of Book	Author	Publication
1	Computed Tomography: Physical Principles, Clinical Applications, and Quality Control	Euclid Seeram RT(R) BSc MSc FCAMRT (Author)	Saunders
2	Computed Tomography for Technologists: A Comprehensive Text	<u>Lois Romans</u>	Lippincott Williams and Wilkins;
3	Computed Tomography: Physics and Technology. A Self Assessment Guide	Euclid Seeram	Wiley-Blackwell
4	The CT Handbook: Optimizing Protocols for Today's Feature-Rich Scanners	<u>Timothy P. Szczykutowicz</u>	Medical Physics Publishing Corporation
5	CT PROTOCOLS	Manjot Kaur, Maajid Mohi Ud Din Malik	JBD Publications


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 (Deemed to be University)

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

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	200
2	1	4	5	30	70	30	70	

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



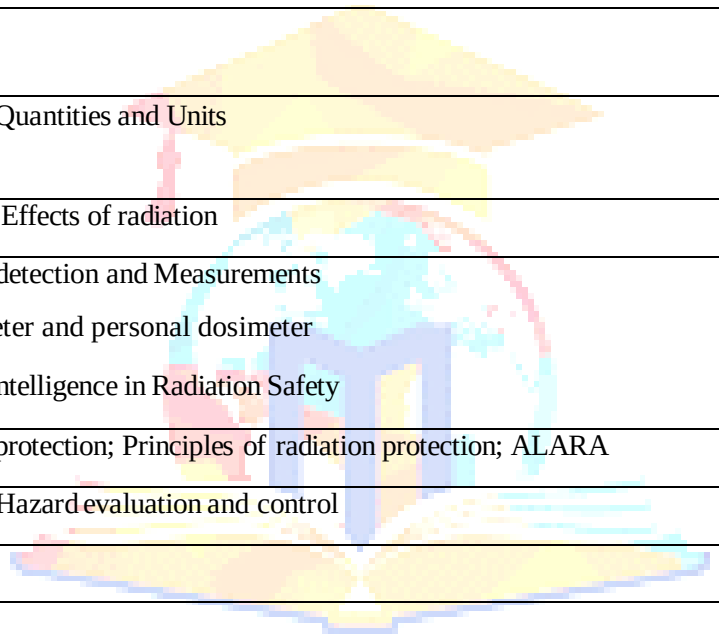
THEORY COMPONENTS

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

Unit	Topic and contents	Hours	Marks
I	Radiation Quantities and Units: Radiation- Radioactivity- Sources of radiation - natural radioactive sources -cosmic rays terrestrial radiation - - man made radiation sources. Units of radiation - Quality factor - Flux-Fluence-Kerma- Exposure- Absorbed dose- Equivalent Dose- Weighting Factors-Effective Dose - Occupational Exposure Limits - Dose limits to public.	7	15
II	Biological Effects of radiation: Ionization, excitation and free radical formation, hydrolysis of water, action of radiation on cell-Chromosomal aberration and its application for the biological dosimetry- Effects of whole body and acute irradiation, dose fractionation, effects of ionizing radiation on each of major organ system including fetus -Somatic effects and hereditary effects- stochastic and deterministic effects-Acute exposure and chronic exposure-LD50 - factors affecting radio sensitivity. Biological effects of non-ionizing radiation like ultrasound, lasers, IR, UV and magnetic fields.	8	15
III	Radiation detection and Measurements: Ionization of gases- Fluorescence and Phosphorescence -Effects on photographic emulsion. Ionization Chambers – proportional counters- G.M counters- scintillation detectors – liquid semiconductor detectors – Gamma ray spectrometer. Measuring systems – free air ionization chamber – thimble ion chamber – condenser chamber – Secondary standard dosimeters – film dosimeter – chemical dosimeter- Thermoluminescent Dosimeter. -Pocket dosimeter-Radiation survey meter- wide range survey meter -zone monitor-contamination monitor -their principle function and uses. Advantages & disadvantages of various detectors &its appropriateness of different detectors for different type of radiation measurement. Dose and Dosimetry, CT Dose Index (CTDI, etc.), Multiple Scan Average Dose (MSAD), Dose Length Product (DLP), Dose Profile, Effective Dose, Phantom Measurement Methods, Dose for Different Application Protocols, Technique Optimization. Dose area product in fluoroscopy and angiography systems, AGD in mammography Artificial Intelligence in Radiation Safety	7	15
IV	Radiation protection: Radiation protection of self and patient- Principles of radiation protection, time - distance and shielding, shielding - calculation and radiation survey –ALARA- personnel dosimeters (TLD and film batches) - occupational exposure.	7	10

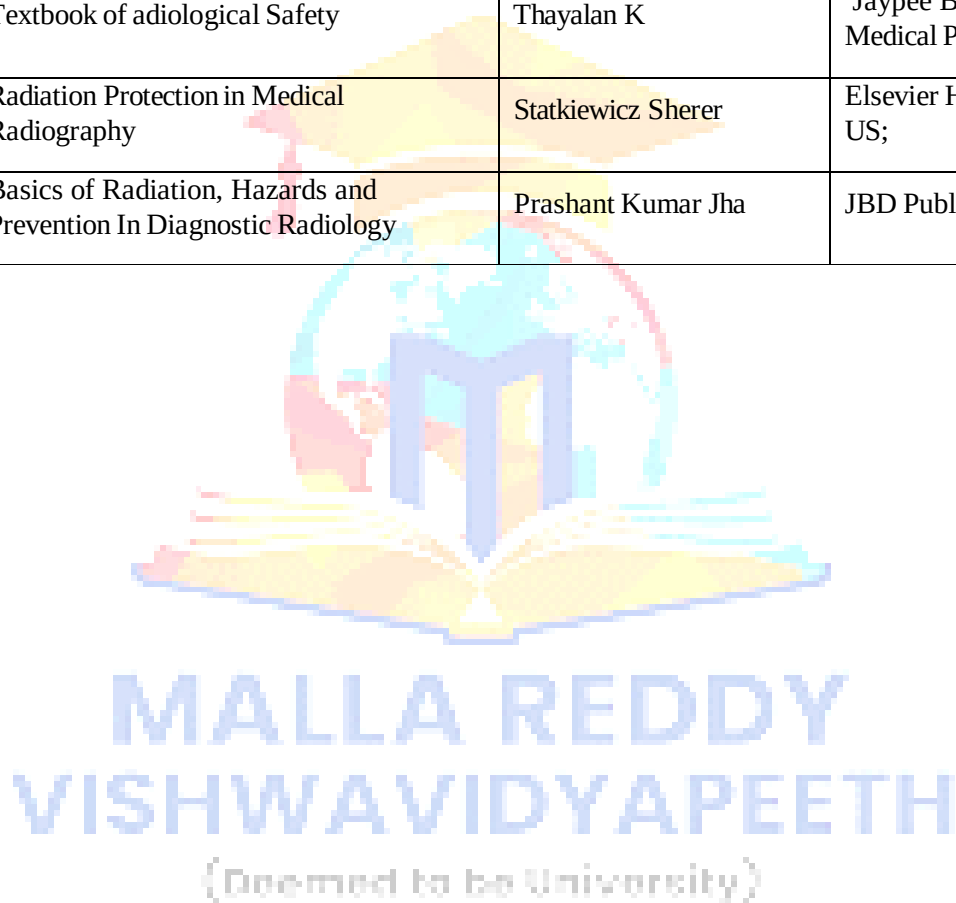
V	Radiation Hazard evaluation and control: Philosophy of Radiation protection, effects of time, Distance & Shielding. Calculation of Work load, weekly calculated dose to radiation worker & General public Good work practice in Diagnostic Radiology. Planning consideration for radiology, including Use factor, occupancy factors, and different shielding material.	7	15
Total		36	70

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


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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 radiological 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



Subject: Quality Assurance in Diagnostic Radiology and Regulatory Requirements

Subject Code: BMRIT -025

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

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	Objectives of quality Control: Improve the quality of imaging thereby increasing the diagnostic value; to reduce the radiation exposure; Reduction of film wastage and repeat examination; to maintain the various diagnostic and imaging units at their optimal performance. Quality assurance activities: Equipment selection phase; Equipment installation and acceptance phase; Operational phase; Preventive maintenance. Quality assurance programme at the radiological faculty level: Responsibility; Purchase; Specifications; Acceptance; Routine testing; Evaluation of results of routine testing; Quality assurance practical	4	--
	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		

II	QA in Diagnostic Radiology filtration Contact between film and intensifying screen Contrast Verification of Optical and Radiation field congruence Beam alignment Focal spot size Linearity of tube current mA and Timer Applied potential HVT and total tube Resolution Grid alignment QA in mammography QA in CT QA in Digital Radiography	4	--
III	Regulatory requirements in Diagnostic Radiology National Regulatory Body Responsibilities and organization Safety Standards Codes and Guides Care and maintenance of diagnostic equipment: General principles and preventive maintenance for routine - daily, Weekly, monthly, quarterly, annually: care in use, special care of mobile equipment	4	--
IV	Responsibilities of licensees, registrants and employers Enforcement of Regulatory requirements Role of technologist in radiology department Maintenance and care of equipment: Safe operation of equipment; Routine cleaning of equipment and instruments; Cassette, screen maintenance; Maintenance of automatic processor and manual processing units; Routine	3	
	maintenance of equipments; Record keeping and log book maintenance; Reject analysis and objectives of reject analysis programme.		
V	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.	3	--



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Total	18	--
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Sr. No		Hours
1.	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	7
2.	QA in Diagnostic Radiology filtration Contact between film and intensifying screen Contrast Verification of Optical and Radiation field congruence Beam alignment Focal spot size Linearity of tube current mA and Timer Applied potential HVT and total tube Resolution Grid alignment QA in mammography QA in CT QA in Digital Radiography	8

Sr. No		Hours
3.	Regulatory requirements in Diagnostic Radiology	7
4.	Responsibilities of licensees, registrants and employers Enforcement of Regulatory requirements	7
5.	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.	7
Total		36

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. Sundhararajan, 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.

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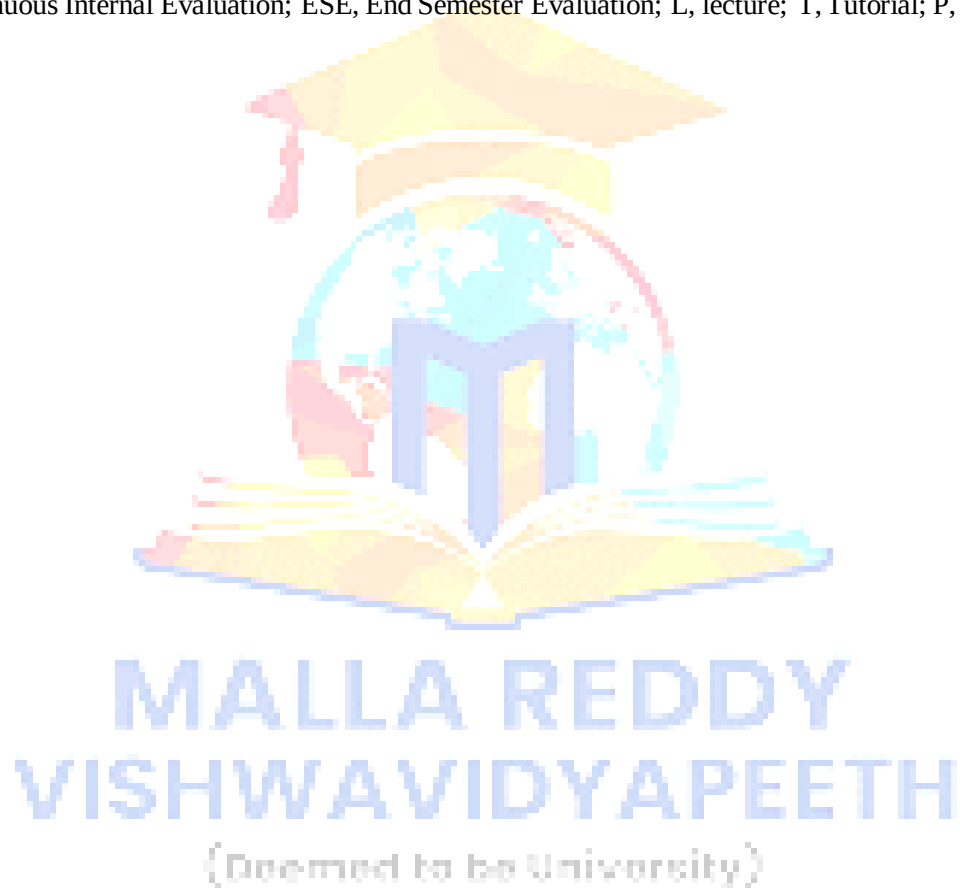
Sixth Semester

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

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme			
				Theory Marks		Practical Marks	
L	T	P	C	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



THEORY COMPONENTS

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

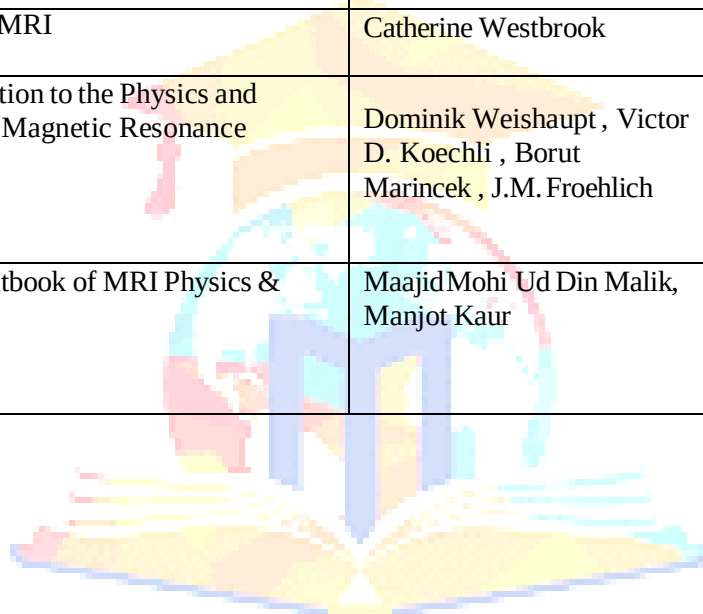
Unit	Topic and contents	Hours	Marks
I	Introduction to MRI; Basic principle; Image weighting and contrast in MRI; Instrumentation of MRI-Magnets- classification, types, advantages, disadvantages, Gradient & Body Coils, RF coils, Shim coils, Ramping, Cryogen, RF shielding	12	15
II	Encoding and Image formation-Encoding, K-Space; Parameters and Trade-offs; MRI Pulse sequences-Spin Echo pulse sequence, Gradient Echo pulse sequence; Fast imaging sequences	12	15
III	Flow phenomena; Flow phenomena compensation; Vascular Imaging-Digital Subtraction MRA, TOF-MRA, PC-MRA, Velocity Encoding, MR-Angiogram, MR- Venogram	10	10
IV	Cardiac Imaging; Whole body MRI Protocols; MRI Artifacts and their compensation; MRI contrast agents-T1 contrast agent, T2 contrast agent	10	15
V	MRI safety- Implants and pace-makers, Electrical safety, Metallic safety, Instrumental safety, Bio-effects of MRI; Documentation; Quality assurance in MRI	10	15
Total		54	70

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

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SUGGESTED LEARNING RESOURCES

S.No.	Title of Book	Author	Publication
1	Tomography and Magnetic Resonance Imaging of the Whole Body (Vol.1& II) (Saunders).	John R. Haaga, Daniel Boll	Elsevier
2	MRI inPractice	Catherine Westbrook & Caralyn Kaut	Wiley-Blackwell
3	Protocols inMRI	Catherine Westbrook	Wiley-Blackwell
4	An Introduction to the Physics and Function of Magnetic Resonance Imaging	Dominik Weishaupt , Victor D. Koechli , Borut Marincek , J.M. Froehlich	Springer;
5	Concise Textbook of MRI Physics & Protocols	MaajidMohi Ud Din Malik, Manjot Kaur	JBD Publications



**MALLA REDDY
VISHWAVIDYAPEETH**
(Deemed to be University)

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

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	--	--	



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	History; Isotopes and Radionuclides- Production of Radionuclides, Transport of Radionuclides; Radio Activity- Radio Active transformations, Specific Activity; Radiopharmaceuticals- Preparation, Precautions while handling	7	25
II	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	7	25
III	Safety Considerations & Radiation Dose in Nuclear Medicine; Room layout in nuclear medicine	4	20
Total		18	70

SUGGESTED LEARNING RESOURCES

Sr.No		Hours
1.	History; Isotopes and Radionuclides- Production of Radionuclides, Transport of Radionuclides; Radio Activity- Radio Active transformations, Specific Activity; Radiopharmaceuticals- Preparation, Precautions while handling	12
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	12
3.	Safety Considerations & Radiation Dose in Nuclear Medicine; Room layout in nuclear medicine	12
Total		36

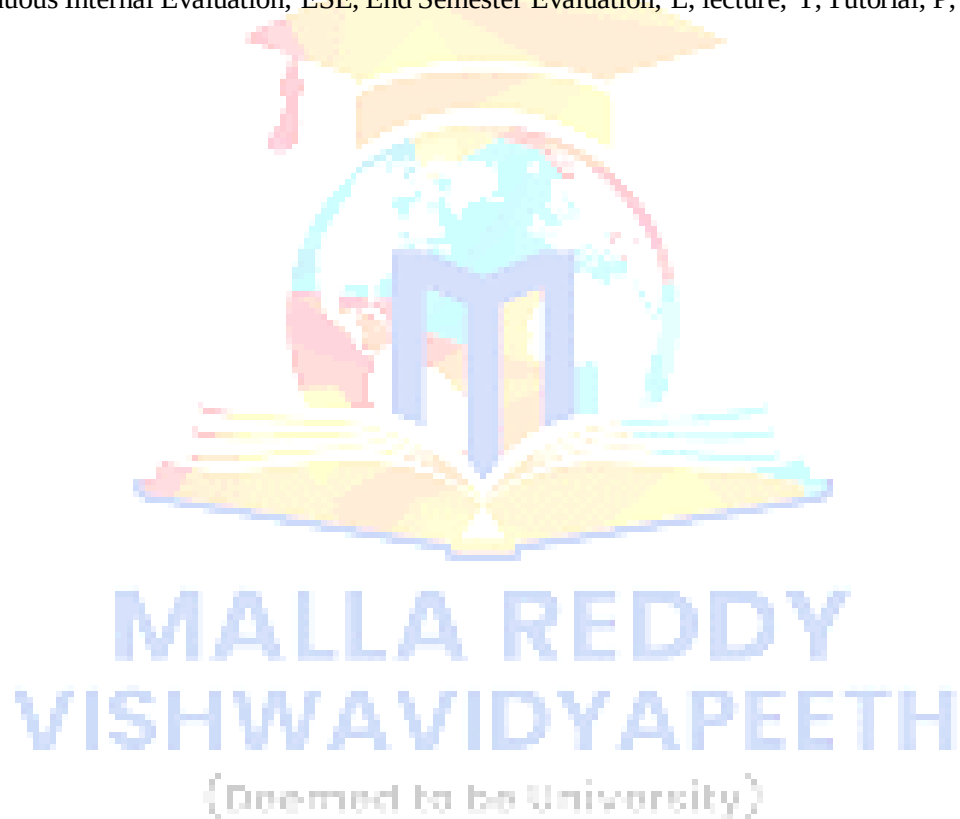
SUGGESTED LEARNING RESOURCES

S.No.	Title of Book	Author	Publication
1	Nuclear Medicine Textbook: Methodology and Clinical Applications	DuccioVolterrani , Paola Anna Erba , IgnasiCarrió, H. William Strauss	Springer;
2	Nuclear Medicine Instrumentation	Jennifer Prekeges (Author)	Jones and Bartlett Publishers
3	Nuclear Medicine Physics: The Basics	Ramesh Chandra & Arman Rahmim	Wolters Kluwer
4	Nuclear Medicine Technology: Procedures and Quick Reference	Pete Shackett BA CNMT ARRT(N) (Author)	LWW;
5	A Concise Guide on Basic Radiation Physics, radiotherapy Physics & Nuclear Medicine	Lalit Agarwal, Dr. Arvind Shukla	JBD Publications

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

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
2	1	--	3	30	70	--	--	

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	Ultrasound: Properties of ultrasound, interaction of ultrasound with matter	6	10
II	Transducers: Types of transducers, advances in the design of modern ultrasound transducers	6	15
III	Image display: Display modes, ultrasound instrumentation, controls, image storage, scan converter memory, photographic film, multi format camera, laser imager, colour and video thermal printer, computer storage, pre and post processing techniques	6	10
IV	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	15
V	Image characteristics and artefacts: vascular, interventional, intraoperative and ophthalmic ultrasonography, 3D and 4D ultrasound imaging Artificial Intelligence in Ultrasound	6	10
VI	Bio-effects and safety considerations in ultrasound, ultrasound system performance measurements, ultrasound equipments quality assurance – conventional Doppler system testing and documentation	6	10
Total		36	70

Sr. No		Hours
1.	Ultrasound interaction of ultrasound with matter	6
2.	Types of transducers, advances in the design of modern ultrasound transducers	6
3.	Image display: Display modes, ultrasound instrumentation, controls	6

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

SUGGESTED LEARNING RESOURCES

S.No.	Title of Book	Author	Publication
1	Ultrasound physics and technology	Vivien gibbs, davidcole, Antonio sassano	Churchill Livingstone;
2	Manual of Diagnostic Ultrasound	Philip E. S. Palmer (Author)	World Health Organization
3	Physics and Technical Aspects Diagnostic Ultrasound	DINESH K BAGHEL (Author)	AITBS PUBLISHERS
4	Diagnostic Ultrasound	Carol M. Rumack (Author), Deborah Levine (Author)	Elsevier;
5	Ultrasound Imaging (1000 Multiple Choice Questions)	Yadav	JBD Publications

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

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.

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
III	Measure of Central Tendency: Need For Measures of Central Tendency; Definition and Calculation of Mean; Ungrouped and Grouped Meaning, Interpretation and Calculation of Median Ungrouped and Grouped; Meaning	3

	and Calculation of Mode; Comparison of the Mean, and Mode; Guidelines for the Use of Various Measures of Central Tendency.	
IV	Measure of Variability: Need For Measure of Dispersion. The Range, the Average Deviation, The Variance and Standard Deviation; Calculation of Variance and Standard Deviation, Ungrouped and Grouped.	3
V	Probability and Standard Distributions: Meaning of Probability of Standard Distribution, The Binominal Distribution. The Normal Distribution; Divergence from Normality - Skewness, Kurtosis	3
VI	Sampling Techniques: Need For Sampling - Criteria for Good Samples. Application of Sampling in Community, Procedures of Sampling and Sampling Designs Errors. Sampling Variation and Tests of Significance.	3
Total		18

SUGGESTED BOOK LEARNINGS

S. No.	Title of Book	Author	Publication
1	Elements of Health Statistics	Rao. N.S	
2	An introduction of Biostatistics	Sunder Rao	
3	Methods in Bio-Statistics	B.K. Mahajan	
4	Elementary Statistics in Medical Workers	Inderbir Singh	
5	An Introduction to. Statistical Methods, Ram Prasad & Sons	Gupta C.B	

(Deemed to be University)

- STUDENTSHIP OR OBSERVER SHIP 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 observer ship/studentship.

"Curriculum Handbook of Medical Radiology and Imaging Technology (Intellectual Property of the National Commission for Allied and Healthcare Professions, Ministry of Health and Family Welfare)."

- 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.

