



**SRI MANAKULA VINAYAGAR**  
**ENGINEERING COLLEGE**  
(An Autonomous Institution)  
Puducherry – 605 107

*2<sup>nd</sup> - Board of Studies Meeting*  
**ALLIED HEALTH SCIENCES**

for the Programmes

1. B.Sc., Medical Laboratory Technology
2. B.Sc., Optometry
3. B.Sc., Radiography & Imaging Technology
4. B.Sc., Cardiac Lab Technology
5. Diploma in Radiography & Imaging Technology
6. Diploma in Medical Laboratory Technology
7. Certificate course in CSSD

*Venue*

College Council Hall  
Sri Manakula Vinayagar Medical College and Hospital  
Kalithirthalkuppam, Puducherry – 605 107

*Date & Time*

25.03.2021 & 09.30 AM

## AGENDA OF THE MEETING

1. To approve the revised curriculum for all the programmes
  - Distribution of Lecture / Practical hours
  - Distribution of marks for CAT & EYE
2. To discuss about the Evaluation Systems
  - Question paper pattern
  - Classification of Degree
3. To approve the criteria for "Pass" in a subject
4. To approve the dates of Model & EYE Examination
5. Any other with the approval of the Chairman of the Programme

## MINUTES OF THE MEETING


Dr.R.Gopal, Dean School of AHS, initiated the meeting by a warm welcome and introduced the External Member the Internal and Co-opted Members and thanked them for accepting the invitation of 2<sup>nd</sup> BOS meeting.

The Chairman proceeded with the presentation to deliberate on agenda items.

<b>Item 1:</b>	The Meeting Confirmed the Minutes of the First BOS Meeting with following changes: <b>Revised curriculum for all the courses :</b> The Chairman & Members of the BOS of the respective Programmes approved the changes made in the Curriculum including teaching hours and distribution of the Marks for CAT and EYE as enclosed( <b>Annexure –I</b> ) The minimum marks for pass in Ancillary Subjects for which only CAT Examination will be held viz English, Computer Science, Environmental Science & Community Medicine, Biostatistics & Ethics, Pharmacology is 50% ( <b>Annexure-I</b> )
<b>Item 2:</b>	The BOS members have approved the Evaluation Systems and recommended to Academic Council
<b>Item 3:</b>	The members have approved the minimum pass percentage as 40% for Theory & Practical separately and the aggregate of both Theory & Practical is 50 %.
<b>Item 4:</b>	Dates of Model Examination and EYE Examination The Members have approved the tentative dates of Model and EYE Examination fixed for the Month of July and August 2021 respectively ( <b>Annexure – II</b> )

<b>Item 5:</b>	The Members have approved the lateral entry of Diploma holders to the Second Year of the B.Sc Programme, subject to fulfillment of the General Rules for Admission
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meeting for 1<sup>st</sup>, 2<sup>nd</sup> and 3<sup>rd</sup> year and syllabi approval was concluded at 1.00 pm with vote of thanks by R. Gopal, Dean School of AHS Sri Manakula Vinayagar Engineering College.

  
DEAN - AHS



Sri Manakula Vinayagar Engineering College  
(An Autonomous Institution), Puducherry  
School of Allied health science

Minutes of the Meeting of Board of Studies

Course: B. Sc Radiography and Imaging Technology and Diploma RGIT

Date: 25.03.2021

Time: 11:30am to 12:30pm

The second meeting of the B.O.S was held on 25/03/2021 at the Academic council hall of SMVEC. The meeting was attended by internal members in person and external members in person or by Google meet. The following persons participated in the meeting.

Sl. No	Name and designation	Responsibility in BOS	Signature
1	Dr. N. Kulasekaran Professor & HOD Dept. of Radiology (Sri Manakula Vinayagar Medical college & Hospital) 9840125148 drkulasekaranficmail.com	Chairman	
2	Dr. A. M. Anand Assistant Professor of Radiology (Sri Manakula Vinayagar Medical college & Hospital) 8940041202 anandradstar@ymail.com	Member	
3	Dr. Umamaheshwari Associate Professor of Radiology (Sri Manakula Vinayagar Medical college & Hospital) 8489210997 dr amirthaumaGnyahoo.co.in	Member	
4	Dz. P. Elamparidhi Assistant Professor of Radiology (Sri Manakula Vinayagar Medical college & Hospital) 7338811211 pepsantoshGa Email.com	Member	
5	Dr. K. Mohamed Rafi Assistant Professor of Radiology (Sri Manakula Vinayagar Medical college & Hospital) 9003339153 radiologistratil984fipmail.com	Member	
6	Dr. Krishnakumar Professor & HOD Department of Radiology	Member (External)	

Dean Academics  
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## **SRI MANAKULA VINAYAGAR ENGINEERING COLLEGE**

(An Autonomous Institution)  
(Approved by AICTE, New Delhi & Affiliated to Pondicherry University)  
(Accredited by NBA-AICTE, New Delhi & Accredited by NAAC with "A" Grade)  
Madagadipet, Puducherry - 605 107



### **SCHOOL OF ALLIED HEALTH SCIENCES**

**B.Sc.IN RADIOGRAPHY AND IMAGING TECHNOLOGY**

**CURRICULLUM & SYLLABI**

**(R-2020)**



## COLLEGE VISION AND MISSION

### VISION

To be globally recognized for excellence in quality education, innovation and research for the transformation of lives to serve the society.

### MISSION

#### M1: Quality Education:

To provide comprehensive academic system that amalgamates the cutting edge technologies with best practices.

#### M2: Research and Innovation:

To foster value based research and innovation in collaboration with industries and institutions globally for creating intellectuals with new avenues.

#### M3: Employability and Entrepreneurship:

To inculcate the employability and entrepreneurial skills through value and skill based training.

#### M4: Ethical Values:

To instill deep sense of human values by blending societal righteousness with academic professionalism for the growth of society.

## DEPARTMENT OF RADIOGRAPHY AND IMAGING TECHNOLOGY

### VISION AND MISSION

#### VISION

To impart quality assurance in medical plethora by amalgamating teaching, research and technology through translucent system of good community.

#### MISSION

##### M1: knowledge sharing:

- To develop and transmit knowledge of diverse aspects of health care delivery and health research

##### M2: Collaborative learning:

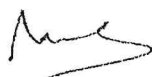
- Accomplishes this mission through collaboration with educators, administrators, , students, industry, healthcare organizations, and other stakeholders through its education, research, advocacy and development activities.

##### M3: Career Development:

- Providing excellent educational programs for health sciences professions students

##### M4: Consistent Improvement:

- Continuously provide quality education, advance knowledge through scholarship and research that improves health and quality of life.







DISTRIBUTION OF TEACHING HOURS FOR 1<sup>ST</sup> YEAR COURSES

Course	Lecture	Practicals	Total
ANATOMY	60	40	100
PHYSIOLOGY	60	40	100
BIO-CHEMISTRY	60	40	100
MICROBIOLOGY	60	40	100
PATHOLOGY	60	40	100
ENGLISH	25	25	50
COMPUTER SCIENCE	25	25	50
CLINICAL POSTING	-	300	300
<b>TOTAL</b>	<b>350</b>	<b>550</b>	<b>900</b>

DISTRIBUTION OF MARKS FOR 1<sup>ST</sup> YEAR COURSES

Course Code	Course	Theory								Practicals						Grand Total	
		*EYE		**CAT		Viva		Total		*EYE		***CAT		Total			
		Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Theory+ Practical	
																Max	Min
U20CTAT11	ANATOMY	60	24	20	8	20	8	100	40	40	16	20	8	60	24	160	80
U20CTAT12	PHYSIOLOGY	60	24	20	8	20	8	100	40	40	16	20	8	60	24	160	80
U20CTAT13	BIO-CHEMISTRY	60	24	20	8	20	8	100	40	40	16	20	8	60	24	160	80
U20CTAT14	MICROBIOLOGY	60	24	20	8	20	8	100	40	40	16	20	8	60	24	160	80
U20CTAT15	PATHOLOGY	60	24	20	8	20	8	100	40	40	16	20	8	60	24	160	80
U20CTAT16	ENGLISH	-	-	-	-	-	-	-	-	-	-	50	25	50	25	50	25
U20CTAT17	COMPUTER SCIENCE	-	-	-	-	-	-	-	-	-	-	50	25	50	25	50	25
<b>TOTAL</b>		-	-	-	-	-	-	<b>500</b>	<b>200</b>	-	-	-	-	<b>400</b>	<b>170</b>	<b>900</b>	<b>450</b>


\*EYE Examination, \*\*CAT Internal Assessment in Theory (Test 15 marks + Attendance 5 marks)

\*\*\*CAT Practicals (Test 10 marks + Attendance 5 marks+ record books 5Marks)

Minimum Marks for Pass is (i) 40% in Theory &Practicals separately.

(ii) 50% in aggregate of both Theory &Practicals combined.

Minimum Marks for Pass in Ancillary Subjects is 50%.



**DISTRIBUTION OF TEACHING HOURS FOR 2<sup>ND</sup> YEAR COURSES**

Course	Lecture	Practicals	Total
RADIOLOGY PHYSICS & RADIATION SAFETY IN RADIO DIAGNOSIS	40	40	80
IMAGING & DARK ROOM TECHNIQUES	50	100	150
RADIOGRAPHIC POSITIONING AND TECHNIQUES	50	100	150
RADIOGRAPHY EQUIPMENTS, MAINTENANCE & QUALITY CONTROL RELATED TO X-RAY ONLY	50	50	100
PHARMACOLOGY	30	-	30
ENVIRONMENTAL SCIENCE AND COMMUNITY MEDICINE	30	-	30
CLINICAL POSTING	-	1200	1200
<b>TOTAL</b>	<b>240</b>	<b>1490</b>	<b>1730</b>

**DISTRIBUTION OF MARKS FOR 2<sup>ND</sup> YEAR COURSES**

Course Code	Course	Theory								Practicals						Grand Total	
		*EYE		**CAT		Viva		Total		*EYE		***CAT		Total		Theory+ Practical	
		Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
U20RITT21	RADIOLOGY PHYSICS & RADIATION SAFETY IN RADIO DIAGNOSIS	60	24	20	8	20	8	100	40	40	16	20	8	60	24	160	80
U20RITT22	IMAGING & DARK ROOM TECHNIQUES	60	24	20	8	20	8	100	40	40	16	20	8	60	24	160	80
U20RITT23	RADIOGRAPHIC POSITIONING AND TECHNIQUES	60	24	20	8	20	8	100	40	40	16	20	8	60	24	160	80
U20RITT24	RADIOGRAPHY EQUIPMENTS MAINTENANCE AND QUALITY CONTROL RELATED TO X-RAY ONLY	-	-	50	25	-	-	50	25	-	-	-	-	-	-	50	25
U20CTAT21	PHARMACOLOGY	-	-	50	25	-	-	50	25	-	-	-	-	-	-	50	25
U20CTAT22	ENVIRONMENTAL SCIENCE AND COMMUNITY MEDICINE	-	-	50	25	-	-	50	25	-	-	-	-	-	-	50	25
<b>TOTAL</b>		-	-	-	-	-	-	450	195	-	-	-	-	180	72	630	315

\*EYE Examination, \*\*CAT Internal Assessment in Theory (Test 15 marks + Attendance 5 marks)

\*\*\*CAT Practicals (Test 10 marks + Attendance 5 marks+ record books 5Marks)

Minimum Marks for Pass is (i) 40% in Theory &Practicals separately.

(ii) 50% in aggregate of both Theory &Practicals combined.

Minimum Marks for Pass in Ancillary Subjects is 50%.

DISTRIBUTION OF TEACHING HOURS FOR 3<sup>RD</sup> YEAR COURSES

Course	Lecture	Practicals	Total
MODERN IMAGING TECHNIQUES & MODALITIES	50	100	150
RADIOGRAPHIC SPECIAL PROCEDURES	50	100	150
BIostatISTICS AND ETHICS	20	10	30
CLINICAL POSTING	-	1200	1200
<b>TOTAL</b>	<b>120</b>	<b>1410</b>	<b>1530</b>

DISTRIBUTION OF MARKS FOR 3<sup>RD</sup> YEAR COURSES

Course Code	Course	Theory								Practicals						Grand Total	
		*EYE		**CAT		Viva		Total		*EYE		***CAT		Total		Theory+ Practical	
		Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
U20RITT31	MODERN IMAGING TECHNIQUES & MODALITIES	60	24	20	8	20	8	100	40	40	16	20	8	60	24	160	80
U20RITT32	RADIOGRAPHIC SPECIAL PROCEDURES	60	24	20	8	20	8	100	40	40	16	20	8	60	24	160	80
U20CTAT31	BIostatISTICS AND ETHICS	-	-	50	25	-	-	50	25	-	-	-	-	-	-	50	25
<b>TOTAL</b>		-	-	-	-	-	-	<b>250</b>	<b>105</b>	-	-	-	-	<b>120</b>	<b>48</b>	<b>370</b>	<b>185</b>

\*EYE Examination, \*\*CAT Internal Assessment in Theory (Test 15 marks + Attendance 5 marks)

\*\*\*CAT Practicals (Test 10 marks + Attendance 5 marks+ record books 5 Marks)

Minimum Marks for Pass is (i) 40% in Theory & Practicals separately.

(ii) 50% in aggregate of both Theory & Practicals combined.

Minimum Marks for Pass in Ancillary Subjects is 50%.



**I-YEAR SYLLABUS**

<b>U20CTAT11</b>	<b>ANATOMY</b>	<b>L</b>	<b>P</b>	<b>Hrs</b>
		<b>60</b>	<b>40</b>	<b>100</b>

**HUMAN BODY AS A WHOLE**

1. Anatomical position
2. Fundamental planes of the body
3. Anatomical terms (superior, inferior, medial, lateral, proximal and distal)
4. Organization of human body
5. Parts of microscope and its functions
6. Epithelium
  - Types
  - functional importance with examples

**LOCOMOTOR SYSTEM**

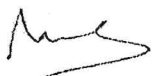
**Skeletal system**

1. Bone composition
2. Long bone
  - Parts
  - blood supply with clinical implication
3. Identify major bones of the body and their parts
4. Classification of synovial joints with associated movements
5. Articular surface of key joints in human body
6. Parts of a muscle and its arrangement
7. Classification of muscles with functional importance
8. Muscles of upper limb, lower limb and head and neck with actions

**NERVOUS SYSTEM**

Classification and components of nervous system

1. Spinal cord
  - Coverings
  - Extent
  - Organization of grey matter and white matter with clinical implication
2. Brainstem
  - Parts
  - Location of cranial nerve nucleus with functions
3. Cerebellum
  - Location
  - Parts
  - Functional subdivisions
  - blood supply and functions



## Curriculum and Syllabi R-2020

### 4. Cerebrum

- Surfaces
- important sulci and gyro and functional correlation

### 5. Thalamus

- location and functional correlation
- Striatum, hippocampus and Amygdala – their location and function.

### 6. Cranialnerves

- Names
- location of nucleus with clinical correlation

## CIRCULATORY SYSTEM

### 1. General plan of circulatory system

### 2. Difference between systemic and portal circulation

### 3. Micro anatomy of artery and vein

### 4. Thoracic cavity

- Bony cage
- muscles – intercostal muscles, diaphragm

### 5. Mediastinum – sub-divisions, contents

### 6. Heart

- Coverings
- External features
- Chambers
- Blood supply
- Nerve supply.

### 7. Major vessels of the heart

### 8. Veins of upper limb and lower limb - varicose veins and their importance

### 9. Lymphatic system – components, micro anatomy of lymphoid organs (lymph node, tonsil, thymus, spleen)

## RESPIRATORY SYSTEM

### 1. Nasal cavity, Para-nasal air sinuses, nasal septum, lateral wall of nose – location and functions

### 2. Pharynx – subdivision and structures present

### 3. Larynx – cartilages, muscles and nerve supply

### 4. Trachea and bronchial tree – extent, broncho-pulmonary segments and their clinical importance

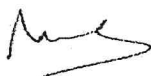
### 5. Pleura – types, reflections, recesses and its clinical importance

### 6. Lung – location, relations, lobes, fissures, surfaces.

## DIGESTIVE SYSTEM

### 1. Abdomen

- Quadrants
- Musculature of wall
- Formation in inguinal canal
- Rectus sheath and their importance



## Curriculum and Syllabi R-2020

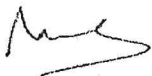
2. Components of digestive system.
3. Mouth - Tongue, palate – Structure of tongue
4. Salivary glands – parotid, sub-mandibular – Brief anatomy and structure
5. Stomach
  - Position
  - Parts
  - Blood supply
  - Nerve supply
  - Lymphatic drainage
  - Relations & structure
6. Small intestine –subdivisions
7. Large intestine in general - sub-divisions, microscopic structure. Specific -caecum and appendix
8. Accessory organs of digestive system
  - Liver
  - Pancreas
  - Extra hepatic biliary apparatus -Gross features, relations, blood supply

## EXCRETORY AND REPRODUCTIVE SYSTEMS

1. Kidney
  - Location
  - Parts
  - Relations and blood supply
2. Ureter & urinary bladder
  - Location
  - Parts
  - Relations and blood supply
3. Male reproductive system
  - Testis
  - Spermatic cord and its coverings
4. Female reproductive system
  - Ovary
  - Uterus – parts and supports
5. Accessory organs of reproduction
  - Prostate gland
  - Mammary gland

## ENDOCRINE SYSTEM

1. List the endocrine glands and their location
2. Thyroid and parathyroid glands
  - Location
  - Relations
  - Blood supply
  - Functions & clinical importance
3. Pituitary gland
  - Location



## Curriculum and Syllabi R-2020

- Parts
  - Relations
  - Blood supply
  - Functions & clinical importance
4. Supra renal gland
- Location
  - Parts
  - Relations
  - Blood supply
  - Functions & clinical importance

### REFERENCE BOOKS:

1. Basics in human anatomy for B.Sc. Paramedical courses, second edition – Priya Ranganath and Leelavathy
2. Anatomy & Physiology in health & illness, 11th edition - Ross & Wilson
3. Vishram Singh, "Clinical and Surgical Anatomy", Elsevier Health Sciences, 2<sup>nd</sup> Edition, 2019.
4. Sampath Madhyastha, "Manipal Manual of Anatomy For Allied Health Sciences", CBS Publishers & Distributors, 3<sup>rd</sup> Edition, 2020.
5. Richard Drake A. Wayne Vogl Adam Mitchell, "Gray's Anatomy for Students – Companion Work Book", Churchill Livingstone Publications, 4<sup>th</sup> Edition, 2019.
6. A K Datta, "Principles Of General Anatomy", Current Books International, 8<sup>th</sup> Edition, 2018.
7. Nafis Ahmad Faruqi, "Human Osteology", CBS Publishers & Distributors, 3<sup>rd</sup> Edition, 2018.
8. Inderbir Singh, "Human Histology", Jaypee Publications, 9<sup>th</sup> Edition, 2019.





## ANATOMY LAB

### PRACTICALS - 40 hrs

1. Identification of the parts of the microscope.
2. Identification of the epithelium in a given histological slide.
3. Demonstrate the parts of the long bone.
4. Identification of the bones and joint of the body with the articular surfaces (skeleton or X-rays)
5. Identification of the important muscles in upper limb, lower limb and head and neck.
6. Identification of the parts of the brain (cerebrum, cerebellum, brainstem, spinal cord)
7. Identification of the cardiac chambers in a specimen.
8. Identification of the major vessels of heart – aorta and pulmonary trunk.
9. Identification of the cardiac field in chest X-ray.
10. Identification of the nasal cavity, naso pharynx, trachea, lung and pleura in a given specimen.
11. Identification of the lung shadow, costophrenic angle in a chest X-ray.
12. Identification of the stomach, pancreas, liver, small intestine and large intestine specimens.
13. Identification of the stomach, intestinal shadows in plain or contrast abdomen X – ray.
14. Identification of the kidney, Ureter and urinary bladder in specimen.
15. Identification of the renal pelvis, Ureter and urinary bladder in intravenous pyelogram
16. Identification of the thyroid gland in cadaveric specimen



<b>U20CTAT12</b>	<b>PHYSIOLOGY</b>	<b>L</b>	<b>P</b>	<b>Hrs</b>
		<b>60</b>	<b>40</b>	<b>100</b>

### **THE CELL**

- Cell Structure and functions of the various organelles.
- Endocytosis and Exocytosis
- Acid base balance and disturbances of acid base balances (Alkalosis, Acidosis)

### **CARDIO VASCULAR SYSTEM**

- Physiology of the heart
- Heart sounds
- Cardiac cycle
- Cardiac output.
- Auscultatory areas.
- Arterial Pressures,
- Blood Pressure
- Hypertension
- Electro cardiogram(ECG)

### **BLOOD:**

- Composition of Blood, functions of the blood and plasma proteins, classification and protein.
- Pathological and Physiological variation of the RBC.
- Function of Hemoglobin
- Erythrocyte Sedimentation Rate (ESR).
- Detailed description about WBC •Total count (TC), Differential count (DC) and functions.
- Platelets–formation

### **RESPIRATORY SYSTEM:**

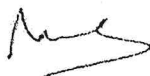
- Respiratory movements.
- Definitions and Normal values of Lung volumes and Lung capacities.

### **EXCRETORY SYSTEM**

- Normal Urinary output
- Micturition
- Renal function tests, renal disorders.

### **REPRODUCTIVE SYSTEM**

- Formation of semen and spermatogenesis.
- Brief account of Menstrual Cycle ,oogenesis



## Curriculum and Syllabi R-2020

### CENTRAL NERVOUS SYSTEM

- Functions of CSF
- Reflexes.
- Sympathetic and parasympathetic outflow Impulse conduction
- Structure of neuron
- Degeneration and regeneration of nerve fibers Cerebral blood flow

### ENDOCRINE SYSTEM

- Functions
- Pituitary
- Thyroid
- Parathyroid
- Adrenal
- Pancreatic Hormones

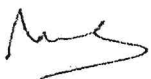
### DIGESTIVE SYSTEM

- Physiological Anatomy of the GIT.
- Food Digestion in the mouth, stomach ,intestine
- Absorption of foods
- Role of bile indigestion.

### SPECIAL SENSES

#### REFERENCE BOOKS:

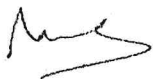
1. Raj Kapoor, " Physiology Practical Manual for Allied Health Sciences", CBS Publishers and Distributors Pvt Ltd, 3<sup>RD</sup> Edition.
2. Marya, "Medical Physiology", CBS Publishers and Distributors Pvt Ltd, 4th Edition.
3. CL Ghai, "Text Book of Practical Physiology", Jaypee Brothers Medical Publishers, 9<sup>th</sup> Edition.
4. Vidya Rattan, "Hand Book of Human Physiology", Jaypee Brothers, 7<sup>th</sup> Edition.
5. Robin R. Preston & Thad Wilson, " Lippincotts Illustrated Reviews in Physiology", Lippincott Williams and Wilkins, 2<sup>nd</sup> Edition.



## PHYSIOLOGY LAB

### PRACTICAL – 40 hrs

1. Microscope
2. Estimation Hemoglobin
3. Blood grouping
4. BT and CT
5. RBC count
6. WBC count
7. PCV
8. ESR
9. Osmotic fragility
10. DLC
11. Measurement of Pulse,HR,RR, Temperature,SPo2
12. Measurement of Blood pressure and auscultate Heart sounds
13. Spotters



U20CTAT13

BIOCHEMISTRY

L	P	Hrs
60	40	100

### CELL AND CELL ORGANELLES

Structure and functions of Cell organelle, membrane structure and transporters

### CARBOHYDRATES

Classification, properties and functions of carbohydrates, Glycolysis, Diabetes Mellitus

### LIPIDS

Classification and functions of lipids, Normal value and functions of Lipoproteins, ketone bodies and ketosis, pathogenesis of Atherosclerosis, cardiac biomarkers

### PROTEINS

Classification of Amino acids, Classification and properties of proteins, Normal value of plasma proteins and their functions.

### ENZYMES

Classification, co-enzymes, Iso-enzymes, enzyme measurement units, enzyme profile in different disorders

### VITAMINS

Functions and deficiency manifestations of fat soluble vitamins, Co-enzyme form, functions and deficiency manifestations of water soluble vitamins.

### MINERALS

Functions and disorders related to minerals like calcium, iron, copper, zinc, iodine, sodium, potassium and chloride.

### NUTRITION

Calorific value of foods, Basal Metabolic Rate , Protein Energy Malnutrition.

### ORGAN FUNCTION TEST


Liver function Test, Renal Function Test, Thyroid Function Test

### ACID BASE BALANCE AND IMBALANCE

pH, Henderson- Hasselbalch equation, buffers, Disorders of Acid base imbalance

### SAMPLE COLLECTION AND TRANSPORT

Types of samples, Anticoagulants, Phlebotomy, Sample Transport



**REFERENCE BOOKS:**

1. Allan Gaw, "Clinical Biochemistry – An Illustrated Colour Text", Churchill Livingstone, 3<sup>rd</sup> edition
2. Nanda Maheshwari, "Clinical Biochemistry ", Jaypee brothers medical publishers, 2<sup>nd</sup> edition
3. Victor Rodwell, "Harper's Illustrated Biochemistry", McGraw-Hill Education, 31<sup>st</sup> edition
4. DmVasudevan, "Text Book of Biochemistry", Jaypee Brothers Medical Publishers , 9<sup>th</sup> edition
5. Harold Varley, "Practical Clinical Biochemistry", CBS, 6<sup>th</sup> edition



## BIOCHEMISTRY LAB

### PRACTICALS – 40 hrs

1. Common Laboratory equipments and glasswares
2. Good Laboratory practices and biomedical waste management.
3. General and colour reactions of carbohydrates.
4. General reactions of proteins .Colour reactions of amino acids.
5. Point of care testing
6. Normal and abnormal constituents of urine analysis



U20CTAT14	MICROBIOLOGY	L	P	Hrs
		60	40	100

### GENERAL BACTERIOLOGY

- **History of Microbiology:** Theory of biogenesis and a biogenesis pioneers in Microbiology (Robert Koch, Louis Pasteur, Joseph lister, Paul enrich, and Koch Postulates.
- **Morphology of bacteria:** Classification based on shape, Anatomy of the bacterial cell, defective forms of bacteria, Bacterial appendages, Bacterial Spore
- **Physiology of bacteria:** Autotrophs, Heterotrophs, Bacterial growth and replication, Bacterial Growth curve, Bacterial count, Bacterial nutrition, Factors affecting the growth.
- **Sterilization & Disinfection:** Introduction, Physical methods, Chemical methods, methods of sterilization and disinfection of medical and laboratory equipments, Disinfection of clinical samples and environmental surfaces in laboratory and hospitals, Testing for infectant.
- **Culture media:** Introduction, basal media, synthetic media, special media with emphasis on their uses.
- **Culture methods:** Aerobic and Anaerobic culture methods.

### IMMUNOLOGY

- Infection - types, Route, source of infections, vector, factors affecting virulence, Exotoxins endotoxins
- Antigen – types factors affecting antigenicity
- Antibodies (Immunoglobulin's)- general properties, IGg, IGA, IGM,IGE,IGD
- Immunity- Innate immunity, Factor affecting & mechanisms of innate immunity Acquired immunity, active & passive
- Ag – Ab reactions – general properties, slide & tube agglutination, precipitation (slide flocculation) prozone phenomeno, coombs test, immune fluoescence assay, Elisa (direct & Indtect) , Immuno chromatography , Applications of Antigen antibodies reactions
- Immune system - cells of lymphoreticular system- lymphocytes, phagocytes structure and functions
- Immune response – humoral & cell mediated immune response, monoclonal antibodies factor affecting anti bodies, adjuvants, immuno suppressive agents, interleukins , immunological tolerance
- Hypersensitivity- Types- immediate &delayed , Type I, IV Hypersensitivity

### SYSTEMIC BACTERIOLOGY

Bacterial infections – morphology, pathology, clinical feature, lab diagnosis, treatment prevention including immune prophylaxis of the following pathogens. No description of culture characters and biochemical reactions

- Staphylococcus
- Streptococcus
- Enterococcus
- Pneumococcus
- C.diphtheriae
- Clostridium tetani
- Clostridium perfringens





## Curriculum and Syllabi R-2020

- Mycobacterium tuberculosis
- Mycobacterium leprae
- E.coli
- Klebsiella Pneumoniae
- Salmonella typhi
- Pseudomonas aeruginosa
- Treponema pallidum
- Vibrio cholera

### **VIROLOGY**

- Introduction and General properties of viruses morphology and general characters susceptibility to physical chemical agents, viral hemagglutinations, cultivations of viruses, cytopathic effects
- Morphology, pathology, clinical feature, lab diagnosis, treatment prevention including immune prophylaxis of the following pathogens:
  - Herpes simplex
  - Varicella zoster
  - Dengue
  - Rabies
  - Hepatitis A,B,C
  - H.I.V
  - Influenza virus
  - Corona virus
  - Measles, mumps & rubella

### **MYCOLOGY**

Introduction – Morphology, General characteristics, classifications, outline of lab diagnosis, Morphology Pathology, clinical feature, lab diagnosis, treatment prevention of the following pathogens

- Candida
- Cryptococcus
- Aspergillus spp

**PARASITOLOGY** Introduction, General Characteristics, Classifications, Brief description of Morphology, Pathogenesis,

Lab diagnosis, Prevention of the following Parasites:

- E. Histolytica
- Giardia
- Malarial Parasite
- Roundworm
- Hookworm

### **APPLIED MICROBIOLOGY**

- BMW
- Immunization



## Curriculum and Syllabi R-2020

- H.A.I & H.I.C
- Standard Precaution

### REFERENCE BOOKS:

1. Richard A Harvey , "Lippincotts Illustrated Reviews In Microbiology", Lippincotts Williams &Wilkins, 3<sup>rd</sup> Edition.
2. Thao Doan, "Lippincotts Illustrated Reviews Immunology", Lippincotts Williams & Wilkins, 2<sup>nd</sup> Edition.
3. ApurbaSastry, "Textbook Of Essentials Of Practical Microbiology", Jaypee Brothers,
4. 1<sup>st</sup> Edition.
5. Baveja, "Textbook Of Practical Microbiology, Arya Publications", 4<sup>th</sup>Edition.
6. JayaramPanikar," Textbook Of Microbiology", Orient Black swan Pvt Limited, 9<sup>th</sup> Edition.
7. Baveja, "Textbook Of Microbiology", Arya Publications, 6<sup>th</sup>Edition.
8. Baveja, "Textbook Of Parasitology" , Arya Publications, 4<sup>th</sup>Edition



## MICROBIOLOGY LAB

### PRACTICALS – 40 hrs

1. Microscope – compound ,DGM, Florescence Microscope
2. Morphology of bacteria
3. Motility – hanging Drop & WET MOUNT
4. Sterilization &Disinfection - Demonstration of equipments and methods
  - Hot air oven, autoclave, ETO, heap filter, syringe filter physical & biological indicators of sterility
  - Packing of glassware and instruments for sterilizations
  - Visit to CSSD
5. Demonstration and use of Centrifuge, & distillation still
6. Preparation of smear from specimen and simple staining
7. Grams stain
8. Culture media
9. Slide and tube agglutination
10. Immuno chromatography
11. Study of bacteria pathogens
  - Staphylococcus
  - Streptococcus
  - Pneumococcus
  - C.diphtheriae
  - Clostridium tetani
  - Clostridium perfringens
  - Mycobacterium tuberculosis
  - Mycobacterium leprae
12. Serological test (ASO, CRP, RAF, Widal, VDRL, HIV, HBV ,Dengue)
13. Study of fungal pathogens
  - Candida
  - Dermatophytes
14. BMWM
15. PPE
16. Standard precautions
17. Examination of stools for parasites
  - E. histolytica
  - G.lamblia
  - Roundworm
  - Hook worm
  - Strongyloides



**U20CTAT15**

**PATHOLOGY**

L	P	Hrs
60	40	100

Introduction to Pathological Terms, techniques  
Cellular adaptations  
Inflammation (Acute & Chronic) Transudate & Exudate  
Wound healing and repair.

**HEMODYNAMICS**

- Oedema
- Thrombus
- Emboli
- Shock

**IMMUNOLOGY**

- Hypersensitivity reactions
- HIV
- Transplant rejection
- SLE

**NEOPLASIA**

- Benign and malignant tumors
- In situ growth
- Familial cancers
- Metastasis

**GENETICS**

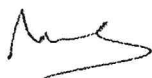
- Chromosome aberrations
- congenital & developmental anomalies

**ENVIRONMENTAL**

- Radiation injury
- Nutritional deficiencies

**INFECTIONS**

- Leprosy
- Syphilis
- Tuberculosis
- Malaria
- Filaria



## Curriculum and Syllabi R-2020

Anaemia and lab investigations Blood grouping & cross matching WBC disorders – Leukemias

### **BLEEDING AND PLATELET DISORDERS**

- BT ( bleeding time)
- CT ( clotting time)
- PT ( prothrombin time)
- APTT ( activated partial thromboplastin time )

### **RESPIRATORY SYSTEM**

- Asthma
- COPD
- Pneumonia & Lung tumours
- pneumoconiosis

### **CVS (CARDIO VASCULAR SYSTEM)**


- Atherosclerosis
- Aneurysms
- Hypertension
- Myocardial Infarction
- Rheumatic heart disease
- Infective endocarditis

### **GIT (gastro intestinal tract)**

- Peptic ulcer
- Carcinoma Stomach
- Amoebiasis
- Typhoid
- TB Intestine
- Carcinoma Intestine

### **HEPATOBIILIARY**

- Liver abscess
- Hepatitis
- Cirrhosis
- Chole Cystitis
- Tumours of liver & gall bladder



## Curriculum and Syllabi R-2020

### **RENAL**

- Nephrotic syndrome
- Nephritic syndrome
- Renal calculi
- Renal failure
- RCC ( renal cell carcinoma)
- CPN ( chronic poly nephritis)

### **BREAST**

- Benign lesions of breast
- Carcinoma breast

### **FGT**

- Carcinoma cervix and endometrium
- Ovarian tumours
- PCOD ( polycystic ovarian disease)
- Leiomyoma

### **CNS(central nervous system)**

- Hydrocephalus
- Meningitis
- Encephalitis
- Cerebro vascular Disease

### **ENDOCRINE**

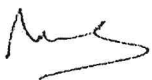
- Diabetes
- Thyroid disorders

### **EYE**

- Infections
- Tumors
- Metabolic diseases

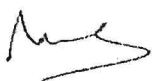
### **BONE**

- Osteomyelitis
- Arthritis
- Osteoporosis
- Bone tumours



**REFERENCE BOOKS:**

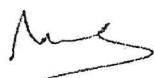
1. NayakRamadas, "Textbook Of Pathology For Allied Health Sciences" ,Jaypee Brothers 1<sup>st</sup> Edition.
2. Nanda Maheshwari, "Clinical Pathology/Hematology and Blood Banking" (For DMLT Students), Jaypee Brothers, 3<sup>rd</sup> Edition.
3. NayakRamadas, "Histopathology Techniques & Its Management", Jaypee Brothers, 1<sup>st</sup> Edition.
4. RamnikSood, "Concise Book of Medical Laboratory Technology Methods and Interpretations", Jaypee Brothers, 2<sup>nd</sup> Edition.
5. Dacie&Lewis, "Practical Hematology", Elsevier Health – UK, 11th Edition.
6. Lippincotts Illustrated Reviews in Pathology.



**PATHOLOGY LAB**

**PRACTICALS – 40 hrs**

1. Urine Examination
2. Hemoglobin Estimation
3. Blood Grouping
4. Peripheral Blood Smear staining
5. Differential count
6. Gross Pathology
7. Microscopic Slides
8. Instruments





U20CTAT16

ENGLISH

L	P	Hrs
25	25	50

**COMMUNICATION**

- Communication at the workplace
- Human needs and communication "Mind mapping" Information communication

**COMPREHENSION PASSAGE**

- Reading purposefully
- Understanding what is read
- Drawing conclusion
- Finding and analysis

**EXPLAINING**

- How to explain clearly
- Explaining procedures
- Giving directions

**WRITING BUSINESS LETTERS**

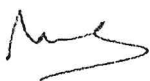
- How to construct correctly Formal language, Address, Salutation
- Body and Conclusion

**REPORT WRITING**

- Reporting an accident
- Reporting what happened at a session
- Reporting what happened at a meeting

**PRACTICAL**

- The clinical experience in the wards and bedside nursing will provide opportunity for students to fulfill the objectives of learning language
- Assignment on writing and conversation through participation in discussion debates seminars and symposia. The students will gain further skills in task oriented communication.



**REFERENCE BOOKS:**

1. SelvaRose. 1997, Career English for Nurses. Published by: Orient BlackswanLtd
2. Oxford advanced Learners Dictionary, 1996
3. Quirk Randolph and Greenbaum Sidney, 1987. A University Grammar of English, Hong Kong: Longman group (FE) Ltd/Pearson.
4. Thomson A.J. and MaituietA.V. 1987, A Practical English Grammar, Delhi: Oxford UniversityPress.
5. Gimson A.C. 1989, An Introduction to pronunciation of English. Hodder Arnold; 4th Revised edition (1 May 1989).
6. O'Connor J.D, 1986. Better English pronunciation. Cambridge: University Press
7. By water F.V.A. 1982, Proficiency Course in English. London: 1- lodder and Stronglton.
8. Roget S.P. 1960, Thesaurus of English Words & Phrases, London: Lowe & Brydone Ltd. 1960.



U20CTAT17

COMPUTER SCIENCE

L	P	Hrs
25	25	50

### TYPING TEXT IN MS WORD

- Inserting tables in a document.
- Formatting the text—using different font sizes, bold, italics
- Bullets and numbering
- Pictures, file insertion
- Aligning the text and justifies
- Choosing paper size
- Adjusting margins
- Header and footer, Inserting page No's in a document Printing a file with options
- Using spell check and grammar

### CREATING TABLE IN 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—Auto formatting—Inserting data from other work sheets.

### PREPARING NEW SLIDES USING MS POWERPOINT

- Inserting slides – Slide transition and animation – Using templates
- Different text and font sizes – Slides with sounds – Inserting clipart, pictures, tables and graphs— Presentation using wizards

### INTRODUCTION TO INTERNET

Using search engine –Google search—Exploring the next using Internet Explorer and Navigator – Uploading and Download of files and images – Email ID creation

- Sending messages – Attaching files in E-mailID
- Typing a text and aligning the text with different formats using MS-Word
- Inserting a table with proper alignment and using MS-Word
- Create emailmergedocument using MS-wordtopreparegreetingsfor10 friends
- Preparing a Slides how with transition, animation and sound effect using MS-PowerPoint
- Customizing the slides how and inserting pictures and tables in the slides using MS- PowerPoint
- Creating a work sheet using MS-Excel with data and use of functions
- Using MS-Excel prepare a worksheet with text, date time and data
- Preparing a chart and pie diagrams using MS-Excel
- Using Internet for searching, uploading files, downloading files and creating E-mailID



Curriculum and Syllabi R-2020

**REFERENCE BOOKS:**

1. Fundamentals of computers- V.Rajaraman-2004
2. Absolute beginners guide to computer basics-Michael Miller. Que Publisher, September 1,2009.
3. Networking concepts and technology – by DeepakKalkadia, Francesco DiMambro, Prentice hall publisher, May 25,2007
4. Operation system concepts (8<sup>th</sup> edition) by AbrahamSilberschatz, Peter Baer Galvin, Greg Gangne, Wiley Publisher, Feb 13,2009.
5. Microsoft office 2013 for Dummies – by Wallace Wang, July 31,2013.



**II-YEAR SYLLABUS**

U20RITT21

**RADIOLOGY PHYSICS & RADIATION SAFETY IN  
RADIO DIAGNOSIS**

**L P Hrs**  
**40 40 80**

**RADIATION PHYSICS**

**BASIC CONCEPTS**

Basic Units, Heat, Acoustics etc., Basic concepts of power, work, force, energy - Einstein's formula - Electronics, Electricity & Magnetism, - electromagnetic waves - Units and measurements - temperature and heat-SI units of above parameters-Atomic structure- Nucleus - Atomic Number, Mass Number electron orbit and energy levels- Periodic table-Isotopes-Isobars-Ionization and excitation.

**ELECTROMAGNETIC INDUCTION:**

Electric charges-electric induction - electric potential- capacitance and capacitors. Electrical energy and power - unit of current-resistance and Ohm's law - circuit laws - heating effect of current - sources of electrical energy - e.m.f. Magnetism-Magnetic effect of an electric current - applications of magnetic field. Electromagnetic induction, laws of mutual induction and self-induction. Alternating current- transformers theory and losses - practical aspects-reactance -resonance - impedance and power factors.

**RADIOACTIVITY**

Natural and artificial radioactivity-alpha decay-beta decay and spectra - gamma emission-positron decay electron capture and internal conversion-Exponential decay-Half life-Unit of activity-specific activity.Nuclear Fission-Nuclear reactor.Radiation sources-Natural and artificial-production of radio isotopes-reactor produced isotopes- Fission products-Gamma ray source for Medical uses.

**INTERACTION OF X-AND GAMMA RAYS**

Attenuation of X-ray or Gamma rays- absorption and scattering-half value layer-coherent scattering-Photo electric absorption-Compton scattering-pair production and photoelectric disintegration. X-Ray transmission through medium-linear and mass attenuation coefficients. HVT - TVT and interaction of charged particle and neutrons with matter. Interaction of X-Ray and Gamma rays in body-fat-soft- tissue-bone-contrast medium- Total attenuation coefficient. Relative important of different types of interactions.


**PHYSICS OF DIAGNOSTIC RADIOLOGY:**

**X-RAY TUBE**

Anode & Cathode - Thermionic diode - X- ray valves and tubes -principle and practical aspects - semiconductors - triode valves - cathode ray oscilloscopes - X-ray circuits - self rectifying circuits - half wave pulsating voltage circuits - full valve pulsating voltage circuits - measurement of high voltage - control of KV circuit - mA circuit. X-ray beam quality

**X-RAY GENERATORS AND CIRCUITS-**

Filament current and voltage, X-Ray circuits Primary circuit-auto transformer-switch and timers- principle of automatic exposure control and practical operation - filament circuit -high voltage circuits - half wave & full wave rectification -three Phase circuits. Types of generators, 3 phase, 6 and 12 pulse circuits- falling load generators- capacitors discharge and grid control systems.



**X-RAY TABLES** - floating top table & variable height table.

**X-Ray Grids /Bucky**

Scattered Radiation -Significance of scatter – Beam limiting devices.–Grid principle and structure – Types of Grids - vertical bucky- versatile bucky -Stationary grid, parallel grid, focused grid – crossed grid, moving grid – Potter Bucky Diaphragm- Control of scattered radiation and grids/Bucky - Methods of minimizing formation of scatter radiation, types of grids and grid ratio- use of cones – diaphragm/ light beam devices - effectiveness of collimation - limitations of the primary beam/the light beam diaphragm -Effects of scatter radiation on radiograph image quality, patient dose and occupational exposure.

**X - RAY CASSETTES& INTENSIFYING SCREENS**

Fluorescence – constituents of intensifying screens – types of screens-intensification factors-speed of screen-screen unsharpness. Cassette-construction-types of cassettes- use of fluorescent screen in radiology, effect of screen in reduction of patient dose.

**PRACTICAL:**

Practical involving not less than 20 numbers must be prescribed to the students.

The title and nature of practical may be framed by the respective institution conducting the course

Study with charts, models & power point presentations Atomic structure, X-ray tubes, X- ray circuits involving students to present and discuss.

**TOPICS:-**

- Congruence of Radiation and Optical field and beam.
- Determination of focal spot size of diagnostic X-ray tube.
- K.V. and Exposure time testing.
- Linearity testing of the Timer.
- Consistency of M.A.loading.
- Consistency of Radiation Output.
- Evaluation of Total filtration of the tube.
- Film screen contact testing.
- Table top Exposure rate measurement in fluoroscopy.
- Radiation protection survey, in and around of diagnostic installations.

**RADIATION SAFETY IN RADIO DIAGNOSISINTRODUCTION TO RADIATION PROTECTION**

- Need for protection
- Aim of radiation protection
- Basic radiation units and quantities
- Exposure
- Absorbed dose
- Absorbed dose equivalent Quality factor
- Tissue weighting actor

**LIMITS FOR RADIATION EXPOSURE**

- Concept of ALARA (ORALARP)
- ICR Regulation
- Maximum permissible dose
- Exposure in pregnancy, children



## Curriculum and Syllabi R-2020

### **PROTECTION IN DIAGNOSTIC RADIOLOGY**

- Protection for primary radiation
- Workload
- Use factor
- Occupancy factor
- Protection for scatter radiation and leakage radiation
- X- ray room design
- Structural shielding
- Protective devices
- Radiation sign ages

### **TECHNICAL PROTECTIVE CONSIDERATION DURING RADIOGRAPHY**

- Evaluation of hazards
- Effective communication
- Immobilization
- Beam limiting devices
- Filtration
- Exposure factors
- Protection in Fluoroscopy
- Mammography
- Mobile radiography CT scan
- Angiography room

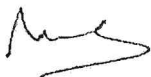
### **RADIATION MEASURING INSTRUMENTS**

- Area monitoring
- Ionization chamber
- GM counter
- Scintillation detector
- Photo film method
- Pocket dose meter
- Personnel dose meters
- Film badge
- TLD
- Solid state detectors
- Chemical dose meters
- Exposure meters and rate meters

Measurement of half value layer

### **BIOLOGICAL ASPECTS OF RADIOLOGICAL PROTECTION**

- Direct & indirect actions of radiation
- Concept of detriment – Deterministic & stochastic effect of radiation – somatic and genetic effects.



## Curriculum and Syllabi R-2020

### REFERENCE BOOKS:

1. Textbook of Radiological Safety by THAYALAN, Jaypee Brothers Medical Publishers
2. Radiation Physics and Physics of Diagnostic Radiology ,A.P. Saxena, Isbn 9789385935930
3. Basic Radiological Physics 2nd Edition, Kindle Edition by KuppusamyThayalan (Author) Publisher Jaypee Brothers Medical Publishers (P)
4. The Physics Of Radiology And Imaging 1St Edition by THAYALAN K, Jaypee Brothers Medical Publishers
5. Christensen's Physics of Diagnostic Radiology, 4/E Paperback – 1 January 1990 by Curry (Author)
6. Radiology Textbook - Concise Textbook of Basic Radiography - Textbook for Radiology Students & Technicians (English, Paperback, LalitAgarwal)
7. Manual Of Clinical Radiological Physics & Recent Advances: A Comprehensive Guide For Radiology Resident 1st Ed. 2020 Paperback – 1 January 2020 by Joseph Varghese, (Author), Anirudh V Nair (Author)





<b>U20RITT22</b>	<b>IMAGING &amp; DARK ROOM TECHNIQUES</b>	<b>L</b>	<b>P</b>	<b>Hrs</b>
		<b>50</b>	<b>100</b>	<b>150</b>

### **X-RAY FILM**

X-ray film construction and film characteristics – Composition of single and double coated radiographic films - structure of emulsion- film characteristics;

Speed, base fog, gamma, latitude -effect of grain size on film response to exposure, interpretation of characteristics curve- exposure to x-rays.

### **TYPES OF RADIOGRAPHIC FILMS**

Applications -advantages/limitations of different types Structure, properties of different parts-Film storage - handling -film wrappings- handling of exposed and unexposed films - safe light requirements.

### **RADIOGRAPHIC IMAGE**

Meaning of radiographic image contrast, density, resolution, sharpness, magnification and distortion of image, noise and blur. Primary radiological image formation- Image quality – unsharpness- resolution – fog and noise - use of contrast media-density- contrast – brightness- optical density measurements- Image recording devices.

### **IMAGE PROCESSING**

Film developing principles- acidity, alkalinity, pH, the processing cycle- process of film developing - development -developer solution- constituents of developer. Fixing- fixer solution- composition of fixer – washing – drying replenishment -checking and adjusting replenishment rates - other processing solution – effect of temperature and development time - film processing methods- common errors and faults while processing manual and automatic processing- latent image formation– silver recovery and economics.

**FILM ARCHIVING SYSTEMS** - Image recording devices-Laser imager/camera functioning.

- Multi formatter- Optical Disc. System
- Film archiving systems - MOD/disc/PACS etc.

### **AUTOMATIC PROCESSING**

Automatic film handling systems -Automated Processors - equipment for Film Processing-functions of various components- film roller transport - transport time -film feed system-Importance and relation to temp, fixed and variable time cycles-Care and maintenance -cleaning routine and methods of cleaning.

**RADIOGRAPHIC ILLUMINATORS:** and viewing conditions, visual acuity and resolution.

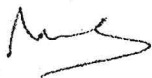
**DARK ROOM-** Site – layout - dark room design- construction- processing area– illumination-safe light compatibility - entrance safe lighting types storage shelving of films-cleaning and maintenance.



Curriculum and Syllabi R-2020

**REFERENCE BOOKS:**

1. Darkroom and Image Processing In Diagnostic Radiology (Yogesh Kumar) AITBS publishers, India
2. The Darkroom Handbook Hardcover – 9 August 1990 by Michael Langford (Author)
3. Dark Room Techniques, A.P. Saxena, 9789385935923
4. Medical Radiographic Techniques and Dark Room Practices by A Krishnamurthy
5. Darkroom and Image Processing In Diagnostic Radiology by Chesney D. N



U20RITT23

**RADIOGRAPHIC POSITIONING &  
TECHNIQUES**

L	P	Hrs
50	100	150

**CONVENTIONAL NON CONTRAST RADIOGRAPHY**

**EXTREMITIES RADIOGRAPHY:**

Hand- Finger –MCP- Wrist joint- Forearm -Elbow joint – humerus - shoulder joint. Foot – Toes- Tarsal bones - Ankle joint - Knee joint – patella – tibia- femur – Hip joint – pelvis -sacroiliac joint.

**SPINE RADIOGRAPHY:**

Vertebral column – Atlanta occipital articulation- cervical spine- dorsal spine lumbar spine – sacrum -vertebral canal- vertebral foramen.

**SKULL RADIOGRAPHY:**

General, sella – temporal bone – mastoid – optic foramen – Internal auditory canal – Superior and inferior orbital fissure – base of skull – facial bones – petrous apex – Zygomatic bone, nasal bone, sinuses of skull – mandible – Tempro- mandibular joint – Paranasal sinuses Radiography.

**CHEST RADIOGRAPHY:**

Basic views (PA & AP) - inspiratory & expiratory films- special chest views & their significance – larynx- trachea- thoracic inlet -Sternum - Ribs – Heart and great vessels – mediastinum - Diaphragm – double exposure technique.

**ABDOMEN & PELVIC RADIOGRAPHY** – all projection – the acute abdomen investigation.

**SOFT TISSUE RADIOGRAPHY:**

Preparations, Instructions, Various techniques, positioning digital mammography, High and low KV Technique – radiography – technique for steep range radiography – intensifying screen.

**STEREO RADIOGRAPHY:**

Conventional and differential filtration – multiple, Duplication – arrangement of Principle – tube shifting relation of patient – correct making and viewing of stereo radiographs – Application.

**MACRO RADIOGRAPHY:**Principle sizes of focal spot its limitation in its application.

**HIGH KV TECHNIQUE:**technique & usefulness.

**BODY LOCALIZATION:**

Preparation – Anatomical localization – various projections – use of skin markers – Tangential projection – uses – opaque – foreign bodies.

**DENTAL RADIOGRAPHY:**

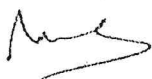
Types of equipments –techniques- indications - films-dental radiography in trauma patients.



Curriculum and Syllabi R-2020

**REFERENCE BOOKS:**

1. A Guide on Special Radiographic Investigations & Techniques, Lalit Agarwal, Dr. Kushal Gehlot
2. Bontrager's Handbook of Radiographic Positioning and Techniques, John Lampignano, Leslie Kendrick
3. Contrast and Special Radiographic Procedures, A.P. Saxena, ISBN 9789385935916
4. Bontrager's Handbook of Radiographic Positioning And Techniques, 1st South Asia Edition John Lampignano, Publisher: Elsevier Science



	<b>RADIOGRAPHY</b>	<b>L</b>	<b>P</b>	<b>Hrs</b>
<b>U20RITT24</b>	<b>EQUIPMENTS, MAINTENANCE &amp; QUALITY CONTROL RELATED TO X-RAY ONLY</b>	<b>50</b>	<b>50</b>	<b>100</b>

**X-RAY MACHINES:**

**X-Ray tube:** Historical aspects - early X-Ray tubes (coolidge tubes) - construction of X-Ray tubes, requirements for X-Ray production (electron source, target and anode material), anode angulation and rotating tubes- tube voltage, current - space charge - tube envelop and housing - cathode assembly, X-Ray production efficiency, advances in X-Ray tubes, Common factors affecting thermionic emission -specialized types- grid controlled and high speed tubes. Inherent filtration, radiation leakage and scattered radiation. Heat dissipation methods- Interlocking and X-Ray tube overload protection -tube rating, heat units, Operating conditions, maintenance and Q.A procedures.

**PORTABLE/MOBILE X-RAY UNITS:**

Equipment for mobile radiography-principle- uses- mobile image intensifiers- Capacitor discharge unit- advantages and limitations -positioning differences-skill in using mobile units - radiation protection.- mobile units types- differences-Cordless mobiles-selection of equipment.

**FLUOROSCOPY:**

Fluoroscopic equipment-Direct fluoroscopy – The serial changer (spot film device) - Fluoroscopic screen - fluoroscopic image -factors affecting the Fluoroscopic image. Image intensifier tubes – principle construction and function regarding intensified image- cine fluorography-mode of operation - Types of day light film handling system- optical coupling and methods of viewing- Automatic brightness control- tilting tables - over and under couch tubes-safety features. The television process – television camera tube– the Cathode ray tube – television image-CCTV. Quality assurance tests for fluoroscopic equipment.

**COMPUTED RADIOGRAPHY (C.R) :**

Equipment parts –advances- principle of imaging– applications- advantages &disadvantages.

**DIGITAL RADIOGRAPHY:**

Principle – photo stimulable phosphors-image acquisition-digital spot imaging - equipment parts –advances- imaging– advantages & disadvantages. Picture characteristics - archiving possibilities- transfer system and designs- Image recording devices-laser imager and multi formatter-Future developments.

**MAMMOGRAPHY:**

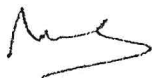
Basic principle, equipment & image acquisition-conventional & digital mammo studies - Mammotomogram.

**DENTAL RADIOGRAPHY:**

Equipment Basics –types of equipments- Intra oral radiography unit - orthopantomograph unit -imaging techniques- Dental films-film types and processing.

**TOMOGRAPHY:**

Theory of tomography – multi section radiography- Tomography equipment-Basic requirements and controls, attachments. Computed tomography – Scanning principle – Reconstruction of image – storing the image Viewing the image – evaluation of the image. Types of movements and applications- Effect on image of variation in focus object distance-Object film distance, exposure angle, and tube movement pattern.



## Curriculum and Syllabi R-2020

### COMPUTED TOMOGRAPHY:

Basic physics – Tomography principle - detectors technology- digital fundamentals- Basic data acquisition concepts -Scanning principle - basics of plain studies- Image reconstruction- artifacts- contrast studies,- special procedures – image quality-storing the image – viewing the image - evaluation of the image- Equipment for computed tomography – Table, scanning gantry X-Ray generator – CT control console. Scanner types - technologic considerations of sequential /spiral volume zoom -computer hard wireof software– CT computer and image processing system- Options and accessories for CT systems.-Tools for use in CT guided Interventional procedures- Dosimetry- Future developments.

### ANGIOGRAPHY EQUIPMENTS:

Basic physics and principle of image acquisition - conventional angio- DSA-Cardiac Cath lab.Equipments- advantages - limitations – Dosimeter – Maintenance.

### PRACTICAL'S

Demonstration of basic procedures with all radiographic equipments

### REFERENCE BOOKS:

1. Care of Patients in Diagnostic Radiography – Chesney and Chesney
2. Guidelines on Patient Care in Radiography – C. Gunn & C.S .Jackson.
3. Darkroomprocedures&Radiography-atextofRadiologyforTechnicianbyLatest edition of Satish K. Bhargava
4. Christensen'sPhysicsofDiagnosticRadiology–LatesteditionofThomasS.Curry.
5. Step by step cross sectional Anatomy by D. Karthikeyan&DeepaChegu.



U20CTAT21

**PHARMACOLOGY**

L	P	Hrs
30	-	30

**INTRODUCTION**

Routes of administration, Pharmacokinetics, Pharmacodynamics, Drugs acting on Autonomic nervous system. Parasympathetic agents and blocking agents. Sympathetic agents and blocking agents Autacoids and respiratory system

- Non-steroidal anti-inflammatory drugs.
- Drugs for cough and bronchial asthma
- Respiratory stimulants and antihistamines Drugs acting on CNS
- Sedatives and hypnotics and alcohol
- General anaesthetics
- Anti-epileptics and Opioids

**DRUGS ACTING ON PNS**

- Smooth muscle relaxants
- Local anaesthetics Drugs acting on CVS
- Drugs for congestive cardiac failure
- Anti-hypertensive drugs
- Anti-arrhythmic drugs
- Anti-anginal drugs and diuretics
- Drugs used in treatment of shock Drugs acting on blood
- Anti-thrombotic drugs
- Anti-coagulants
- Fibrinolytic drugs
- Lipid lowering drugs
- Antimicrobial drugs Drugs acting on GIT

**DRUGS USED FOR ENDOCRINE DISORDERS**

- Insulin, oral hypoglycemic drugs Corticosteroids
- Thyroxine and anti-thyroid drugs

General concepts and resistance. Antibacterial drugs Antiviral drugs Anti-fungal drugs .Antiseptics and disinfectants Management of poisoned patients

**REFERENCE BOOKS:**

1. Lippincott's Illustrated Review's in Pharmacology -Seventh edition
2. Medical Pharmacology by Padmaja Uday Kumar- Seventh edition
3. Pharmacology for medical graduates by Tara Shanbhag – Fourth edition



U20CTAT22

**ENVIRONMENTAL SCIENCE &  
COMMUNITY MEDICINE**

L	P	Hrs
30	-	30

**ENVIRONMENTAL SCIENCE (15 hrs)**

1. Introduction to environment
2. Sources, health hazards and control of environmental pollution
3. Water
4. The concept of safe and wholesome water
5. The requirements of sanitary sources of water
6. Understanding the methods of purifications of water on small scale and large scale various biological standards, including WHO guidelines for third world countries
7. Concept and methods for assessing quality of water.
8. Domestic refuse, sullage, human excreta and sewage their effects on environment and health, methods and issue related to their disposal.
9. Awareness of standards of housing and the effect of poor housing on health.
10. Role of arthropods in the causation of diseases, mode of transmission of arthropods borne diseases, methods of control

**REFERENCE BOOKS:**


1. Text book of Environmental studies for Under Graduate courses by ErachBarucha

**COMMUNITY MEDICINE (15 hrs)**

1. Epidemiology and Epidemiological Methods AIM / Approach / Rates/
2. Mortality / Morbidity and Disease transmission
3. Epidemiology of Communicable diseases
4. Epidemiology of Non-communicable diseases
5. Bio-medical waste Management
6. Disaster Management
7. Information, Communication and Health Education.
8. Screening for disease
9. History of Public Health
10. Organization of Health services
11. Health Care Delivery system

**REFERENCE BOOKS:**

1. Park's text book of Preventive and social Medicine – 23<sup>rd</sup> Edition(2015)
2. Community Medicine with recent advances by A.H. SuryaKantha
3. Short text book of preventive and social medicine by G.N.Prabhakar
4. Text book of community medicine – By Sunderlal.





**III-YEAR SYLLABUS**

<b>U20RITT31</b>	<b>MODERN IMAGING TECHNIQUES &amp; MODALITIES</b>	<b>L</b>	<b>P</b>	<b>Hrs</b>
		<b>50</b>	<b>100</b>	<b>150</b>

**MAMMOGRAPHY:**

The Mammography as a clinical diagnostic tool- immobilization and identification techniques-positioning techniques for various projections - exposure factors- Conventional & Digital studies- quality and advantage- diagnosis and screening- Characteristics of benign and malignant lesions – patient care – female attendant- interventional procedures - radiation dose- recent advances in mammography techniques - mammotomogram&Sonomammography procedures- advantages & limitations.

**ULTRASONOGRAPHY/ DOPPLERSTUDIES:**

Techniques of sonography-selection- Preparations - instructions and positioning of patient for TAS, TVS, TRUS, neck USG and extremities- patient care and maintenance protocols-clinical applications display methods –quality image reproducible extend -assurance to patients.

**CT SCAN STUDIES ACQUISITION/ PROTOCOLS/TECHNIQUES:**

CT of head and neck – thorax – abdomen – pelvis – musculo skeletal system – spine – PNS. Anatomy – clinical indications and contraindications – patient preparation – technique – contrast media-types, dose, injection technique; timing, sequence - image display – patient care – utilization of available techniques & image processing facilities to guide the clinician-CT anatomy and pathology of different organ systems.

**MRI - SCANNER:**


Methods of MRI imaging methods – Head and Neck ,Thorax, Abdomen, Musculoskeletal System imaging - Clinical indications and contraindications-types of common sequences-effects of sequence on imaging - Protocols for various studies- slice section- patient preparation-positioning of the patient -patient care-calibration - paramagnetic agents and dose, additional techniques and recent advances in MRI -image acquisition-modification of procedures in an unconscious or un co-operative patient – plain studies- contrast studies -special procedures- reconstructions- 3D images- MRS blood flow imaging, diffusion/perfusion scans - strength and limitations of MRI- role of radiographer.

**ANGIOGRAPHY AND CINE STUDIES/DSA**

Conventional / DSA studies- Abdominal, visceral, peripheral, cerebral and cardiac angiography - arterial/venous anatomy, physiology-clinical indications and contraindications - patient preparation-positioning of the patient -patient care- contrast media - types of contrast - dosage - accessories catheters, guide wires- pressure injection- control of radiographic and fluoroscopic equipment - exposure factors for serial programmes-programming-injection protocols- outline on each radiological procedure- radiographer's role- patient management before -during and after the procedure-venography- interventional angiography inhepatobiliary, GIT, urology and vascular system –coils/stents etc-indication and contra-indications-role of radiographer –radiation safety.

**NUCLEAR SCINTISCANPROCEDURES:**

SPECT-CT & PET-CT studies, protocols, Basics of common clinical Nuclear Medicine procedures/techniques–comparison with different structural imaging studies- advantages and limitations.



## RECENT ADVANCES IN IMAGING

Dynamic CT & MRI studies:

Pre-operative application of various imaging systems including detector probes application in Nuclear Medicine Imaging guidance in therapeutic procedures-IGRT, TACE & TARE etc.

## EQUIPMENTS OF ADVANCED MODALITIES

### MAMMOGRAPHY SYSTEM:

History - Imaging requirements- Mammography system - construction/types accessories - tube, compression, grids, AEC etc- nature of X-Ray beam suitable accessories for immobilization - film processing - image quality - image recording devices - interventional procedures - accessories-biopsy equipment attachments - radiation dose - mammo tomogram-Sonomammography-future developments.

### ULTRASONOGRAPHY/ DOPPLER SYSTEMS:

Basic acoustics principle- Basic physics of sound propagation in different media, production of Ultrasound (piezoelectric effect), ultrasound terminologies - interaction of ultrasound with matter - ultrasound properties propagation in tissue, absorption, scattering, reflection and refraction- acoustic impedance-piezo electric effect - transducer - Pulsar - receiver - beam/sensitivity and gain - generators- A, B and M scanning & echo modes- transducers-techniques of sonography-equipment selection- display methods - ultrasound image formation - data storage and display - image and artifacts - doppler instrumentation -doppler equation - transducer - quality assurance and performance tests - bio effects and safety considerations. Types of machines -portable systems- acoustic coupling agents-ingredients/preparation.

### CT SCAN SYSTEMS:


History- generations of scanners-CT technology -helical/spiral & multi slice C.T- ultra fast scanners-system components - performance parameters - image quality and methods of image reconstruction- radiation dose measurements and technical aspects of Q.A -calibration and image acquisition-

### MRI - SCANNERS:

History - basic physical principle - Physical principles -NMR signals- instrumentation- hard ware-MR system components- magnet system- Magnetic shielding- RF shielding- bio effects of MRI- site selection and safety -reconstruction system - different coils used -NMR signals advantage -imaging methods - pulse imaging sequences - spectroscopy parameters -calibration and image acquisition - reconstructions- 3D images- - image contrast factors affecting image quality - artifacts - difference between CT and MRI images-host computer-viewing archiving-hardcopy-image formation and storage device.

### ANGIOGRAPHY AND CINE STUDIES/DSA

Angiography equipments history -Conventional angiography X-Ray equipment - Equipment construction-principle - DSA system basics - digital techniques-subtraction process-procedures for subtraction - care, choice and installation of the equipment - equipment, pitfalls and complications -pressure injectors- contrast media -accessories-catheters, guide wires-uses of serial imaging devices- cine camera - video-recorder -film processing-radiation protection.



### **NUCLEAR MEDICINE EQUIPMENTS**

Nuclear Physics - basics in Nuclear Medicine- Nuclear medicine equipments - Gamma Cameras- rectilinear scanners- radioisotope generators-SPECT-CT & PET- CT- introduction-basic physics and principle involved-equipments basic structure differences- fusion techniques- image formation-storage devices- advantages-limitations.

### **RECENT ADVANCES IN IMAGING SYSTEMS**

Mobile units of Computer Radiography & Digital Radiography system. 3D/4D Sonography systems  
128 slice & higher slice C.T equipments. 3 Tesla & higher T MRI scanners

Image processing & Display systems-Recent advances, concepts and applications in processing of images in digital form using computer based systems.

Bone Densitometry

### **PICTURE ARCHIVING AND COMMUNICATION SYSTEMS**

**(PACS)**- newer advancements – updates - systems designs-transfer restrictions.

### **REFERENCE BOOKS:**

1. Step by Step CT; Step by Step MRI and MRI made Easy for beginners – GovindB. Chavhan – Jaypee brothers and Medical Publishers (p) Ltd, New Delhi CT & MRI protocol – Satish K. Bhargava, CBSpublishers
2. Text book of Radiology for residents and technicians -4<sup>th</sup> edition –Satish.KBhargava CBS publishers and distributors (p) Ltd.
3. Concepts in Medical Radiographic Imaging – MarianneTortoise
4. Radiographic Imaging -Derrick
5. Processing and Quality Control –William



		L	P	Hrs
U20RITT32	RADIOGRAPHIC SPECIAL PROCEDURES	50	100	150

### NON-CONTRAST SPECIAL RADIOGRAPHY

#### PAEDIATRIC IMAGING:

Special needs of patient and radiographer- use of dedicated equipment and accessories-modified technical considerations - selection of exposure factors- image quality considerations - radiation protection of the patient - special techniques in children for contrast studies.

#### GERIATRIC RADIOGRAPHY:

Equipment and accessories – exposure factor considerations in special care. Elderly patients profile - difficulties during radiography – technical considerations- projections with unconventional special positioning.

#### TRAUMA/EMERGENCY RADIOGRAPHY:

Selection of suitable X-Ray equipment – patient position -radiographic projections and sequence for each patient – modification of routine positioning– radiation protection – patient care.

#### OPERATION THEATRE RADIOGRAPHY:

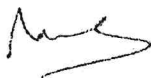
O.T procedures-Operative cholangiography – orthopaedic procedures – maintenance of asepsis – preparation of radiographer and equipment/accessories - careful safe use of mobile and fluoroscopic equipment – radiation protection – patient care – rapid availability of radiographic image-cooperation with OT staff- type of studies done -clinical applications - clinical applications- per operative radiographs- pre-operative fluoroscopy studies -patient care-radiation protection of all staff.

#### CONTRAST RADIOGRAPHY:

Radiological contrast media – classification-need for radiological contrast media-methods of administration-dosage-reactions to contrast media- role of radiographer in management of patient with contrast reaction. For all contrast investigations-patient preparation, positioning, patient care during the study-post procedural patient care-types of contrast media used and dosage- alternative contrast used-side effects and its identification-treatment of complication during the procedure - pathological conditions- indications and contraindications-injection procedure – techniques for radiographic projections - radiographic appearances– radiation protection.

#### SIALOGRAM

- Barium studies- different types – Barium swallow Barium meal study of upper GIT, Barium meal follow through, Barium enema, small bowel enema, distal colography, defaecography.
- Percutaneous Transhepatic Cholangiogram, ERCP, T-Tube cholangiography, pre-operative cholangiography.
- VP-rapid sequence-infusion pyelography-high dose urography, Cystogram, Anterior Urethrogram RGU, MCU, RCP
- Angiography, Diagnostic & therapeutic, venography, Lymphangiogram
- Orthography, Discography
- Myelogram,
- Hysterosalpingography.
- Sinography.
- Fistulogram,



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- Ductogram.

### REFERENCE BOOKS:

1. Fundamentals of Special Radiographic Procedures –Albert M Snopek published by Elseveir
2. A guide on Special Radiographic Investigations and Techniques – Dr.Kushal Gehlot and Lalit Agarwal published by JBD



U20CTAT31

**BIOSTATISTICS AND ETHICS**

L	P	Hrs
20	10	30

**BIostatistics (15 hrs)**

- Introduction to Statistics
- Scales of Measurement
- Collection and Presentation of data
- Measures of Central tendency
- Measures of Variation
- Probability
- Binomial and Normal distribution
- Sampling Methods
- Sample size determination
- Correlation and Regression
- Statistical Significance
- Non-Parametric tests
- Health Statistics including hospital statistics

**REFERENCE BOOKS:**

1. KR Sundaram, SN Dwivedi and V Sreenivas (2010): Medical Statistics, Principles and Methods, BI Publications Pvt Ltd, New Delhi, India.
2. A Indrayan (2008): Basic Methods of Medical Research, Second edition, AITBS Publishers, India.
3. NSN Rao and NS Murthy (2008): Applied Statistics in Health Sciences, First Edition, JAYPEE brothers medical publishers (P) Ltd, India.

**MEDICAL ETHICS (15Hrs)**

1. Medical ethics - Definition - Goal -Scope
2. Code of conduct - Introduction–Basic principles of medical ethics–Confidentiality
3. Malpractice and negligence
4. Rational and irrational drug therapy
5. Autonomy and informed consent Rights of patients
6. Care of the terminally ill-Euthanasia
7. Organ transplantation
8. Medico legal aspects of medical records – Medical legal case and type- Records and document related to MLC - ownership of medical records - Confidentiality Privilege communication - Release of medical information - Unauthorized disclosure- retention of medical records- other various aspects.

**REFERENCE BOOKS:**

1. Medical Ethics Manual-The Pocket Manual
2. The Medical Ethics Today The BMA's Handbook of Ethics and Law –The British Medical Association

