Revised Ordinance Governing Regulations and Curriculum of

B.Sc. MEDICAL IMAGING TECHNOLOGY

COURSE - 2019

Rajiv Gandhi University of Health Sciences, Karnataka, Bangalore

The Emblem

The Emblem of the Rajiv Gandhi University of Health Sciences is a symbolic expression of the confluence of both Eastern and Western Health Sciences. A central wand with entwined snakes symbolises Greek and Roman Gods of Health called Hermis and Mercury is adapted as symbol of modern medical science. The pot above depicts Amrutha Kalasham of Dhanvanthri the father of all Health Sciences. The wings above it depicts Human Soul called Hamsa (Swan) in Indian philosophy. The rising Sun at the top symbolises knowledge and enlightenment. The two twigs of leaves in western philosophy symbolises Olive branches, which is an expression of Peace, Love and Harmony. In Hindu Philosophy it depicts the Vanaspathi (also called as Oushadi) held in the hands of Dhanvanthri, which are the source of all Medicines. The lamp at the bottom depicts human energy (kundalini). The script "Devahitham Yadayahu" inside the lamp is taken from Upanishath Shanthi Manthram (Bhadram Karnebhi Shrunuyanadev…), which says "May we live the full span of our lives allotted by God in perfect health" which is the motto of the Rajiv Gandhi University of Health Sciences.

ರಾಜೀವ್ ಗಾಂಧಿ ಆರೋಗ್ಯ ವಿಜ್ಞಾನಗಳ ವಿಶ್ವವಿದ್ಯಾಲಯ, ಕರ್ನಾಟಕ, ಬೆಂಗಳೂರು
RAJIV GANDHI UNIVERSITY OF HEALTH SCIENCES, KARNATAKA, BENGALURU
4th T Block, Jayanagar, Bengaluru – 560 041

Ref: ACA/DCD/AHS/B.Sc.MIT/363/2019-20 **Date: 28/08/2019**

NOTIFICATION

Sub: Revised Ordinance pertaining to Regulation and Curriculum of B.Sc. Medical Imaging Technology.

Ref: 1) Minutes of BOS Allied Health Sciences held on 13/05/2019
2) Proceedings of Faculty meeting held on 15/05/2019
3) Proceedings of AC meeting held on 17/06/2019
4) Proceedings of Syndicate meeting held on 29/06/2019

In exercise of the powers vested under Section 35(2) of RGUHS Act, 1994, the Revised Ordinance pertaining to Regulation and the curriculum of B.Sc. Medical Imaging Technology is notified here with as per Annexure.

The above Regulation shall be applicable to the students admitted to the said course from the academic year 2019-20 onwards.

By Order,

Sd/-

REGISTRAR

To

The Principals of all affiliated Allied Health Sciences Course colleges of RGUHS, Bangalore.

Copy to:

1. The Principal Secretary to Governor, Raj Bhavan, Bangalore - 560001
2. The Principal Secretary Medical Education, Health & Family Welfare Dept., M S Building, Dr.B.R. Ambedkar Veedhi, Bangalore – 01
3. PA to Vice – Chancellor/PA to Registrar/Registrar (Eva.)/Finance Officer, Rajiv Gandhi University Health Sciences, Bangalore
4. All Officers of the University Examination Branch/ Academic Section.
5. Guard File / Office copy.

REVISED ORDINANCE GOVERNING REGULATIONS & CURRICULUM OF B.Sc. MEDICAL IMAGING TECHNOLOGY - 2019

1. Eligibility for admission:

A candidate seeking admission to the BSc. Medical Imaging Technology shall have studied English as one of the principal subjects during the tenure of the course and shall have passed:

1. Two-year Pre-University examination or equivalent as recognized by Rajiv Gandhi University of Health Sciences with, Physics, Chemistry and Biology as subjects of study.

OR

2. Pre-Degree course from a recognized University considered as equivalent by RGUHS, (Two years after ten years of schooling) with Physics, Chemistry and Biology as subjects of study.

OR

3. Any equivalent examination recognized by the Rajiv Gandhi University of Health Sciences, Bangalore for the above purpose with Physics, Chemistry and Biology as subjects of study.

OR

4. The vocational higher secondary education course conducted by Vocational Higher Secondary Education, Government of Kerala with five subjects including Physics, Chemistry, Biology and English in addition to vocational subjects conducted is considered equivalent to plus TWO examinations of Government of Karnataka Pre University Course.

OR

5. Candidates with two years diploma from a recognized Government Board in Medical Imaging Technology shall have passed class 12 [10+2] with Physics, Chemistry and Biology, as subjects or candidates with 3 years diploma from a recognized Government Board in Medical Imaging Technology should have studied Physics, Biology and Chemistry as subjects during the tenure of the course.

6. Lateral entry to second year of B.Sc. Medical Imaging Technology for candidates who have passed diploma program from the Government Boards and recognized by RGUHS, fulfilling the conditions specified above under Sl. No. 5 and these students are eligible to take admission on lateral entry system only in the same subject studied at diploma level from the academic year 2008-09 vide RGUHS Notification no. AUTH/AHS/317/2008-09 dated:01.08.2008.

7. **Note:**

a. The candidate shall have passed individually in each of the subjects.

b. Candidates who have completed diploma or vocational course through Correspondence shall not be eligible for any of the courses mentioned above.

2. Duration of the course:

Duration shall be for a period of four years including one year of Internship.

3. Medium of instruction:

The medium of instruction and examination shall be in English.

4. Scheme of examination:

There shall be three examinations one each at the end of 1st, 2nd and 3rd year.

5. Attendance

Every candidate should have attended at least 80% of the total number of classes conducted in an academic year from the date of commencement of the term to the last working day as notified by university in each of the subjects prescribed for that year separately in theory and practical. Only such candidates are eligible to appear for the university examinations in their first attempt. Special classes conducted for any purpose shall not be considered for the calculation of percentage of attendance for eligibility. A candidate lacking in prescribed percentage of attendance in any subjects either in theory or practical in the first appearance will not be eligible to appear for the University Examination in that subject

Internal Assessment (IA):

1st Year B.Sc. MIT
Theory - 20 marks
Practical's - 10 marks*. [Lab work- 06 marks and Record-04 marks]

2nd & 3rd year B.Sc. MIT
Theory – 20 Marks
Practical's – 20 Marks

There shall be a minimum of two periodical tests preferably one in each term in theory and practical of each subject in an academic year. The average marks of the two tests will be calculated and reduced to 20. The marks of IA shall be communicated to the University at least 15 days before the commencement of the University examination. The University shall have access to the records of such periodical tests. The marks of the internal assessment must be displayed on the notice board of the respective colleges within a fortnight from the date test is held. If a candidate is absent for any one of the tests due to genuine and satisfactory reasons, such a candidate may be given a re-test within a fortnight.

There shall be no University Practical Examination in First year.

6. Subject and hours of teaching for Theory and Practical's

The number of hours of teaching theory and practical, subject wise in first year, second year and third year are shown in Table-I, Table-II and Table-III

Main and Subsidiary subjects are common in first year for all the courses in Allied Health Science.

The number of hours for teaching theory and practical for main subjects in first, Second and Third year are shown in Table-I, II and III.

SCHEME OF CURRICULUM

Table – I: Distribution of Teaching Hours in First Year

Main subjects

Sl. No	Subjets	Theory No. of Hours	Practical No. of Hours	Total No. of Hours
1	Human Anatomy	70	20	90
2	Physiology	70	20	90
3	Biochemistry	70	20	90
4	Pathology (Clinical Pathology, Haematology & Blood Banking)	70	20	90
5	Microbiology	70	20	90
	Total	**350**	**100**	**450**

The classes in main and subsidiary subjects are to be held from Monday to Thursday. On Fridays and Saturday's students shall work in hospitals in the respective specialty or department chosen by them.

Subsidiary Subjects

English 25 Hours

Kannada 25 Hours

Healthcare 40 Hours

Clinical/Lab posting – 470 hours

(Friday 9am – 1pm and 2pm - 4-30 pm, Saturday 9am - 1pm)

Table – II: Distribution of Teaching Hours in Second Year Subjects

Main subjects

Sl. No	Subjets	Theory No. of Hours	Practical No. of Hours	Total No. of Hours
1	Radiation Physics: Medical Physics & Radiation Safety in Radio Diagnosis	100	-	100
2	Imaging Physics & Dark Room Techniques	80	-	80

3	Radiographic Positioning and Techniques	100	300	400
	Total	**280**	**300**	**580**

Subsidiary Subjects:

Sociology - 20 Hours

Constitution of India – 10 Hours

Environmental Science & Health - 10 Hours

Table - III Distribution of Teaching Hours in Third Year Subjects

Main subjects

Sl. No	Subjects	Theory No. of Hours	Practical No. of Hours	Total No. of Hours
1	Diagnostic Imaging Techniques & Modalities	200	300	500
2	Radiographic Special Procedures and Patient Care	100	300	400
	Total	**300**	**600**	**900**

Subsidiary Subjects:

Ethics, Database Management – 50 Hours

Research & Biostatistics - 20 Hours

Computer application - 10 Hours

7. Schedule of Examination:

The university shall conduct two examinations annually at an interval of not less than 4 to 6 months as notified by the university from time to time. A candidate who satisfies the requirement of attendance, progress and conduct as stipulated by the university shall be eligible to appear for the university examination. Certificate to that effect shall be produced from the Head of the institution along with the application for examination and the prescribed fee.

8. Scheme of Examination

There shall be three examinations, one each at the end of I, II and III year. The examination for both main and subsidiary subjects for all courses in Allied Health Sciences shall be common in the first year. Distribution of Subjects and marks for First Year, second year & Third year University theory and practical Examinations are shown in the Table – IV, V & VI.

First year examination:

The University examination for 1st year shall consist of only theory examination and there shall be no University Practical Examination.

Second- & Third-year examination:

The University examination for 2nd and 3rd year shall consist of Written Examination & Practical.

Written Examinations consists of

05 papers in the 1st

year 03 papers in the

2nd Year

03 papers in the 3rd Year.

Practical examination:

One practical examination at the end 2nd year and two practical examinations at the end of the 3rd year.

TABLE-IV

Distribution of Subjects and marks for First Year University Theory Examination

Sl. No.	Main Subjects*	Written Paper		I A Theory	Total
		Duration	Marks	Marks	Marks
1	Basic Anatomy (Including Histology)	3 Hours	100	20	120
2	Physiology	3 Hours	100	20	120
3	Biochemistry	3 Hours	100	20	120
4	Pathology	3 Hours	100	20	120
5	Microbiology	3 Hours	100	20	120
	Subsidiary Subject**				
1	English	3 Hours	80	20	100
2	Kannada	3 Hours	80	20	100
3	Health Care	3 Hours	80	20	100

Note: I A = Internal Assessment

*Main Subjects shall have University Examination.

There shall be no University Practical Examination.

**Subsidiary subjects: Examination for subsidiary subjects shall be conducted by respective colleges.

TABLE – V

Distribution of Subjects and marks for Second Year Examination of B.Sc. MIT

Sl. No.	Main Subjects*	Theory			Practical's			
	Subject	Univ. Exam	IA	Sub Total	Univ. Practical	IA	Sub Total	Grand Total

1.	Radiation Physics: Medical Physics & Radiation Safety in Radio Diagnosis	100	20	120	-----	--	---	120
2.	Imaging Physics & Dark Room Techniques	100		100	80 (40+40)	20	100	200
3.	Radiographic Positioning and Techniques	100		100	------	--	---	100

Distribution of Subsidiary Subjects and marks for Second Year Examination of B.Sc. MIT

Sl. No.	Subsidiary Subject	Duration	Marks	I A Theory Marks	Total Marks
1	Sociology	3 Hours	80	20	100
2	Constitution of India	3 Hours	80	20	100
3	Environmental Science & Health	3 Hours	80	20	100

*******Subsidiary subjects: Examination for subsidiary subjects shall be conducted by respective colleges.

TABLE - VI

Distribution of Subjects and marks for Third Year Examination of B.Sc. MIT

Sl. No.		Theory				Practical's			
	Subject	Univ. exam	Viva Voice	IA	Sub Total	Univ. Practical	IA	Sub Total	Grand Total
1.	Diagnostic Imaging Techniques & Modalities	100	--	20	120	80 (40+40)	20	100	220
2.	Radiographic Special Procedures and Patient Care	100	--	20	120	-----	----	----	120
3.	Radiographic Positioning and Special Procedures	-----	-----	----	-----	80 (40+40)	20	100	100

Distribution of Subsidiary Subjects and marks for Third Year Examination of B.Sc. MIT

Sl. No.	Subsidiary Subject**	Duration	Marks	I A Theory Marks	Total Marks

1	Ethics, Database Management	3 Hours	80	20	100
2	Research & Biostatistics	3 Hours	80	20	100
3	Computer Application	3 Hours	80	20	100

** Subsidiary subjects: Examination for subsidiary subjects shall be conducted by respective colleges.

9. Pass criteria

9.1. First year examination

a. Main Subjects: A candidate is declared to have passed in a subject, if he/she secures,50% of marks in University Theory exam and internal assessment added together.

b. Subsidiary Subjects: The minimum prescribed marks for a pass in subsidiary subject shall be 35% of the maximum marks prescribed for a subject. The marks obtained in the subsidiary subjects shall be communicated to the University before the commencement of the University examination.

9.2. Second- and Third-year Examination

a. Main Subjects: A candidate is declared to have passed the examination in a subject if he/she secures 50% of the marks in Theory and 50% in practical separately. For a pass in theory, a candidate has to secure a minimum of 40% marks in the University conducted written examination, and 50% in aggregate in the University conducted written examination and internal assessment added together and for pass in Practical, a candidate has to secure a minimum of 40% marks in the university conducted Practical/Clinical examination and 50% in aggregate i.e. University conducted Practical/Clinical and Internal Assessment.

b. Subsidiary Subjects: The minimum prescribed marks for a pass in subsidiary subject shall be 35% of the maximum marks prescribed for a subject. The marks obtained in the subsidiary subjects shall be communicated to the University before the commencement of the University examination.

10. Carry over benefit

10.1 First year examination:

A candidate who fails in any two of the five main subjects of first year shall be permitted to carry over those subjects to second year. However, he/ she must pass the carry over subjects before appearing for second year examination.

10.2. Second year examination:

A candidate is permitted to carry over any one main subject to the third year but shall pass this subject before appearing for the third-year examination.

11. Declaration of Class

a. A candidate having appeared in all the subjects in the same examination and passed that examination in the first attempt and secures 75% of marks or more of grand total marks prescribed will be declared to have passed the examination with Distinction.

b. A candidate having appeared in all subjects in the same examination and passed that examination in the first attempt and secures 60% of marks or more but less than 75% of grand total marks prescribed will be declared to have passed the examination in First Class.

c. A candidate having appeared in all the subjects in the same examination and passed that examination in the first attempt and secures 50% of marks or more but less than60% of grand total marks prescribed will be declared to have passed the examination in Second Class.

d. A candidate passing the university examination in more than one attempt shall be placed in Pass class irrespective of the percentage of marks secured by him/her in the examination.

e. The marks obtained by a candidate in the subsidiary subjects shall not be considered for award of Class or Rank.

[Please note, fraction of marks should not be rounded off clauses (a), (b) and (c)]

12. Eligibility for the award of Degree:

A candidate shall have passed in all the subjects of first, second and third year to be eligible for a compulsory one year of rotational internship. One-year compulsory rotational postings during which students have to work under the supervision of experienced staff. On completion of one year of the internship the candidate is then eligible for the award of degree.

13. Distribution of Type of Questions and Marks for Various Subjects

THEORY

SUBJECTS HAVING MAXIMUM MARKS = 100 (for First year)		
Type of Questions	**No. of Questions**	**Marks for Each Questions**
Long Essay	02	10
Short Essay	10	05
Short Answer	10	03

1. Long essay- 2 Questions (Second question choice) 2x10= 20 marks
2. Short essay- 10 Questions (Questions no 5 &10 choice) 10x5= 50 marks
3. Short answer- 10 Questions (Questions no 15 & 20 choice) 10x3= 30 marks

Total= 100

SUBJECTS HAVING MAXIMUM MARKS = 100 (for Second and Third Year)		
Type of Questions	**No. of Questions**	**Marks for Each Questions**
Long Essay	02	10
Short Essay	10	05
Short Answer	10	03

1. Long essay- 2 Questions (Second question choice) 2x10= 20 marks
2. Short essay- 10 Questions (Questions no 5 &10 choice) 10x5= 50 marks
3. Short answer- 10 Questions (No choice) 10x3= 30 marks

Total= 100

SUBJECTS HAVING MAXIMUM MARKS = 80 subsidiary subjects		
Type of Questions	**No. of Questions**	**Marks for Each Questions**
Essay Type	02	10
Short Essay Type	06	05
Short Answer Type	10	02

1. Long essay- 2 Questions (Second question choice) 2x 10=20 marks
2. Short essay- 05 Questions (Questions no 5 &10 choice) 6x 5= 30 marks
3. Short answer- 10 Questions (Questions no 15 & 20 choice) 10x 3= 30 marks

Total= 80 marks

First Year B.Sc. Medical Imaging Technology

ANATOMY

Theory: 70 hours
Practical's: 20 hours

Chapter 1: Introduction:

Theory:

- *Definition of anatomy and its divisions*
- Terms of location, positions and planes
- Epithelium-definition, classification, describe with examples, function
- Glands- classification, describe serous, mucous & mixed glands with examples
- Basic tissues – classification with examples

Practical:

- Histology of types of epithelium
- Histology of serous, mucous & mixed salivary gland

Chapter 2: Connective tissue:

Theory:

- Cartilage – types with example & histology theory
- Bone – Classification, names of bone cells, parts of long bone, microscopy of compact
- bone, names of all bones, vertebral column, intervertebral disc, fontanelles of fetal skull
- Joints – Classification of joints with examples, synovial joint (in detail for radiology)

- Muscular system: Classification of muscular tissue & histology
- Names of muscles of the body

Practical:

- Histology of the 3 types of cartilage
- Histology of compact bone (TS & LS)
- Histology of skeletal (TS & LS) & cardiac muscle
- Demo of all bones showing parts, radiographs of normal bones & joints
- Demonstration of important muscles of the body

Chapter 3: Cardiovascular system:

Theory:

- Heart-size, location, chambers, exterior & interior, pericardium
- Blood supply of heart
- Systemic & pulmonary circulation
- Branches of aorta, common carotid artery, subclavian artery, axillary artery, brachial artery, superficial palmar arch, femoral artery, internal iliac artery
- Inferior vena cava, portal vein, portosystemic anastomosis, Great saphenous vein, Dural venous sinuses
- Lymphatic system- cisterna chyli & thoracic duct, Histology of lymphatic tissues, Names of regional lymphatics, axillary and inguinal lymph nodes in brief

Practical:

- Demonstration of heart and vessels in the body
- Histology of large artery & vein, medium sized artery & vein
- Histology of lymph node, spleen, tonsil & thymus
- Radiology: Normal chest radiograph showing heart shadows

Chapter 4: Gastro-intestinal system

Theory:

- Parts of GIT: Oral cavity (lip, tongue (with histology), tonsil, dentition, pharynx, salivary glands, Waldeyer's ring), Oesophagus, stomach, small and large intestine, liver, gall bladder, pancreas, spleen, peritoneum & reflections

Practical:

- Demonstration of parts of GIT
- Radiographs of abdomen

Chapter 5: Respiratory system

Theory:

- Parts of RS: nose, nasal cavity, larynx, trachea, lungs, bronchopulmonary segments, diaphragm
- Histology of trachea, lung and pleura
- Names of paranasal air sinuses

Practical:

- Demonstration of parts of respiratory system.
- Normal radiographs of chest, X-ray paranasal sinuses
- Histology of lung and trachea

Chapter 6: Urinary system:

Theory:

- Kidney, ureter, urinary bladder, male and female urethra
- Histology of kidney, ureter and urinary bladder **Practical:**
- Demonstration of parts of urinary system
- Histology of kidney, ureter, urinary bladder
- Radiographs of abdomen-IVP, retrograde cystogram

Chapter 7: Reproductive system:

Theory:

- Parts of male reproductive system, testis, vas deferens, epididymis, prostate (gross & histology)
- Parts of female reproductive system, uterus, fallopian tubes, ovary (gross & histology) •
- Mammary gland – gross

Practical:

- Demonstration of section of male and female pelvis with organs in situ
- Histology of testis, vas deferens, epididymis, prostate, uterus, fallopian tubes, ovary
- Radiographs of pelvis – hysterosalpingogram

Chapter 8: Endocrine glands:

Theory:

- Names of all endocrine glands in detail on pituitary gland, thyroid gland& suprarenal gland – (gross & histology)

Practical:

- Demonstration of the glands
- Histology of pituitary, thyroid, parathyroid, suprarenal glands

Chapter 9: Nervous system:

Theory:

- Neuron & Classification of NS
- Cerebrum, cerebellum, midbrain, pons, medulla oblongata, spinal cord with spinal nerve (gross & histology) Meninges, Ventricles & cerebrospinal fluid, Names of basal nuclei
- Blood supply of brain
- Cranial nerves
- Sympathetic trunk & names of parasympathetic ganglia

Practical:

- Histology of peripheral nerve & optic nerve
- Demonstration of all plexuses and nerves in the body
- Demonstration of all part of brain
- Histology of cerebrum, cerebellum, spinal cord

Chapter 10: Sensory organs:

Theory:

- Skin: Skin-histology & Appendages of skin
- Eye: Parts of eye & lacrimal apparatus, Extra-ocular muscles & nerve supply
- Ear: parts of ear- external, middle and inner ear and contents

Practical:

- Histology of thin and thick skin
- Demonstration and histology of eyeball
- Histology of cornea & retina

Chapter 11: Embryology:

Theory:

- Spermatogenesis & oogenesis
- Ovulation, fertilization
- Fetal circulation
- Placenta

INTERNAL ASSESSMENT:

Theory: Average of 2 exams conducted 20

Practical's: Record and lab work* 10

*There shall be no university practical examination and internal assessment marks secured in Practical's need not be sent to the university.

SCHEME OF EXAMINATION THEORY

There shall be one theory paper of three hours duration carrying 100 marks.

Distribution of type of questions and marks for Anatomy shall be as given under.

SUBJECTS HAVING MAXIMUM MARKS= 100 (for First year)		
Type of Questions	**No. of Questions**	**Marks for Each Questions**
Long Essay	2	10
Short Essay	10	05
Short Answer	10	03

1. Long essay- 2 Questions (Second question choice) 2x10= 20 marks
2. Short essay- 10 Questions (Questions no 5 &10 choice) 10x5= 50 marks
3. Short answer- 10 Questions (Questions no 15 & 20 choice) 10x3= 30 marks

Total= 100

Distribution of Marks for University Theory and Practical Exam

Theory				**Practicals**			**Grand Total**
Theory	Viva Voce	IA	Sub Total	Practicals	IA	Sub Total	
100	--	20	120	*			120

REFERENCE BOOKS:

1. William Davis (P) understanding Human Anatomy and Physiology – McGraw Hill
2. Chaursia- A Text Book of Anatomy
3. T. S. Ranganathan- A Text Book of Human Anatomy
4. Fattana, Human Anatomy (Description and applied) - Saunder's & C P Prism Publishers, Bangalore

5. ESTER. M. Grishcimer- Physiology & Anatomy with Practical Considerations, J. P. Lippin Cott. Philadelphia
6. Bhatnagar- Essentials of Human Embryology- Revised Edition. Orient Blackswan Pvt. Ltd.

PHYSIOLOGY

Theory - 70 hours
Practical - 20hours

1. General Physiology

- Introduction to cell physiology, transport across cell membrane, Homeostasis.
- Body Fluid compartment & measurement.

2. Blood

- Introduction- composition and function of blood Plasma proteins, types and functions
- Red blood cells - erythropoiesis, stages of differentiation, factors affecting it, function, normal count, physiological variation.
- Hemoglobin- function, concentration, types & methods of Hb estimation, fate of hemoglobin Jaundice- types Anemia, - types
- ESR, PCV, osmotic fragility & blood indices
- WBC- morphology, production, functions, normal count, differential count, variation, variation Immunity (in brief)
- Platelets- origin, morphology, normal count, function-Platelet plug, bleeding disorder
- Haemostasis - definition, normal haemostasis, clotting factors, mechanism of clotting, anticoagulants disorders of clotting factors.
- Blood group-ABO & Rh system, Rh incompatibility blood typing, cross matching, hazards of mismatched blood transfusion
- RES, spleen and lymph.

3. Nerve-Muscle

- Neuron structure, types, neuroglia-types, nerve fiber classification, properties of nerve fibers, RMP, action potential, wallerian degeneration
- NMJ, blockers, Myasthenia gravis
- Classification of muscle, structure of skeletal muscle, sarcomere, contractile proteins, Excitation, contraction, coupling, mechanism of muscle contraction, types of contraction, Motor unit, fatigue, rigor mortis, Smooth muscle.

4. Respiratory system

- Physiological anatomy of respiratory system, muscles of respiration, respiratory & non respiratory functions of lungs, dead space
- Mechanics of breathing, intrapulmonary & pleural pressures Compliance, Surfactant, Hyaline membrane disease
- Lung volumes and capacities
- Respiratory membrane, transport of O_2 & CO_2

- Chemical regulation of respiration Neural regulation of respiration Hypoxia, Acclamatization, Dysbarism. Artificial respiration
- Definition-Periodic breathing, dyspnoea, apnoea, asphyxia, cyanosis.

5. Cardiovascular system

- Introduction to CVS & general principles of circulation Properties of Cardiac muscle Cardiac cycle, heart sounds, Pulse Cardiac output, factors and measurement Heart rate
- BP-factors, measurement, Short term regulation Intermediate and long-term regulation of BP
- ECG uses and significance, normal waveform, heart block Coronary circulation, Cutaneous circulation- Triple response Shock
- Effects of exercise on CVS and Respiratory system.

6. Renal system, Skin and body temperature

- Kidneys- functions, structure of nephron, type, juxtaglomerular apparatus-structure and function, non- excretory functions of kidney.
- Glomerular filtration rate (GFR)- Definition, normal value, factors affecting GFR Tubular reabsorption - sites, substance reabsorbed, mechanisms of reabsorption Tubular secretion- sites, substance secreted, mechanisms of reabsorption.
- Counter current mechanism of concentration of urine Obligatory and Facultative reabsorption of water Micturition reflex, Diuretics.
- Artificial kidney, renal function tests-clearance tests
- Skin -structure and function, body temperature measurement, physiological variation.
- Regulation of body Temperature by physical chemical and nervous mechanisms-Role of Hypothalamus Hypothermia and fever.

7. Digestive system

- Physiological anatomy, Enteric nervous system & functions of GIT Saliva- composition, regulation, disorder.
- Deglutition- stages & disorders
- Stomach-functions, composition and regulation of gastric juice Gastric motility, MMC, vomiting reflex. Pancreas- function, composition and regulation of pancreatic juice
- Liver & gall bladder-functions, bile- composition, secretion and regulation Small intestine- Succus entericus-composition, functions & movements Large intestine- functions, movements and defecation reflex
- Digestion & absorption of Carbohydrates, fats and proteins.

8. Endocrine system

- Classification of Endocrine glands & their hormones & properties-chemistry and receptor, feedback mechanisms of hormone regulation.
- Anterior pituitary hormones- secretion, functions, disorders Posterior pituitary hormones- secretion, functions, disorders Thyroid hormones- secretion, functions, disorders
- Parathyroid hormones- secretion, functions, disorders Calcium homeostasis & disorders Pancreatic hormones, -Insulin and Glucagon secretion, functions, disorders
- Adrenal cortex- Glucocorticoids & Mineralocorticoids, Androgen - secretion, functions, disorders Adrenal medulla- secretion, functions, disorders Thymus & Pineal gland.

9. Reproductive system

- Introduction to reproductive system, sex differentiation & Puberty Male reproductive system, functions of testosterone & Spermatogenesis
- Female reproductive system, functions of Estrogen, Progesterone, Oogenesis Ovulation & Menstrual
  cycle Physiological changes during pregnancy, pregnancy tests, parturition & lactation Male & Female contraceptive methods.

10. Central nervous system

- Introduction to CNS, Sensory receptors classification, properties Synapse– classification, properties Sensory pathways: Anterior spin thalamic tract and Posterior column pathway
- Lateral spin thalamic tract, Types of pain, Referred pain, Thalamus; nuclei and function

- Classification of reflexes, Monosynaptic reflex- Stretch reflex, muscle spindle, inverse stretch reflex. Polysynaptic reflex-Withdrawal reflex
- Motor pathways: Pyramidal pathway and functions, UMNL, LMNL Cerebral cortex (Sensory and motor)- functions, Medulla and Pons-functions Cerebellum –functions, disorders
- Basal ganglia-functions, disorders Hypothalamus and Limbic system-functions CSF, lumbar puncture Sleep, EEG,
- Autonomic Nervous System - Sympathetic and parasympathetic distribution and functions.

11. Special senses

- Vision –Functional anatomy of eye, visual pathway, lesion Refractive errors, color vision
- Audition – Physiological anatomy of ear, Mechanism of hearing, auditory pathway, deafness Olfaction – modalities, receptor, function, abnormalities
- Gustation-modalities, receptor, function, taste pathway, abnormalities.

Practical's

- Blood pressure recording auscultation for heart sounds.
- Artificial respiration determination of vital capacity.

INTERNAL ASSESSMENT

Theory - Average of 2 exams conducted
- 20

Practical's: Record and lab work* - 10

SCHEME OF EXAMINATION THEORY

There shall be one theory paper of three hours duration carrying 100 marks.

Distribution of type of questions and marks for Physiology shall be as given under.

SUBJECTS HAVING MAXIMUM MARKS= 100 (for First year)		
Type of Questions	**No. of Questions**	**Marks for Each Questions**

Long Essay	2	10
Short Essay	10	05
Short Answer	10	03

1. Long essay- 2 Questions (Second question choice) 2x10= 20 marks
2. Short essay- 10 Questions (Questions no 5 &10 choice) 10x5= 50 marks
3. Short answer- 10 Questions (Questions no 15 & 20 choice) 10x3= 30 marks

Total= 100

Distribution of Marks for University Theory and Practical Exam

Theory				**Practical's**			**Grand Total**
Theory	Viva Voce	IA	Sub Total	Practical's	IA	Sub Total	
100	--	20	120	*			**120**

REFERENCE BOOKS:

1. Guyton (Arthur) Text Book of Physiology. Latest Ed. Prism Publishers

2. Chatterjee (CC) Human Physiology Latest Ed. Vol. 1, Medical Allied Agency

3. Choudhari (Sujith K) Concise Medical Physiology Latest Ed. New Central Book **4.** Ganong (William F) Review of Medical Physiology. Latest Ed. Appleton

BIOCHEMISTRY

No. Theory classes: 70 hours
No. Practical classes: 20 hours

1. Carbohydrate Chemistry [3 hours]

- Classification (Definition/ examples for each class)
- Monosaccharides (classification depending upon number of carbon atoms and functional group with examples)
- Disaccharides (Sucrose/ lactose/ maltose and their composition) • Polysaccharides:
  a) Homopolysaccharides (Structure of starch and glycogen)
  b) Heteropolysaccharides (Functions).

2. Lipid Chemistry [3 hours]

- Definition of lipids
- Functions of lipids in the body
- Classification of lipids (subclasses with examples)
- Definition and Classification of fatty acids
- Essential fatty acids
- Phospholipids and their importance

3. Amino-acid and Protein Chemistry [3 hours]

- General structure of D and L amino acids
- Amino acids; Definition and Classification of amino acids with examples.
- Peptides; definition & Biologically important peptides
- Classification of Proteins based on composition, functions and shape (with examples) • Functions of amino acids and Proteins.

4. Nucleotide and Nucleic acid Chemistry [3 hours]

- Nucleosides & Nucleotides
- Nucleic acid Definition & types
- Composition & functions of DNA & RNA
- Structure of DNA (Watson and Crick model)
- Structure of tRNA, & functions of tRNA, rRNA, mRNA
- Difference between DNA and RNA.

5. Enzymes [5 hours]

- Definition & Classification of Enzymes with example • Definitions of Active site, Cofactor (Coenzyme, Activator),
- Proenzyme; Definition and examples (Pepsin & trypsin).

6. Digestion and Absorption [3 Hours]

- General characteristics of digestion and absorption,
- Digestion and absorption of carbohydrates, proteins and lipids.

7. Carbohydrate Metabolism [5 Hours]

- Glycolysis; Aerobic, Anaerobic, Definition, Site and subcellular site, Steps with all the enzymes and coenzymes at each step, mention the regulatory enzymes, Energetics,
- Citric acid cycle; Pyruvate dehydrogenase complex (reaction and coenzymes), Site and subcellular site, Reactions with all the enzymes and coenzymes, Regulatory enzymes, Energetics
- Significance of HMP Shunt pathway.
- Hyperglycemic and hypoglycemic hormones
- Blood Glucose Regulation.
- Diabetes mellitus (definition, classification, signs and symptoms)
- Glycogen metabolism and gluconeogenesis.

8. Lipid Metabolism [4 Hours]

- Introduction to lipid metabolism, Lipolysis
- Beta oxidation of fatty acids; Definition, Site and subcellular site, Activation of palmitic acid, Transport of activated palmitic acid into mitochondria, Reactions, Energetics.
- Name the different ketone bodies. Note on ketosis.

9. Amino acid and Protein Metabolism [3 Hours]

• Introduction, transamination, deamination, Fate of ammonia, transport of ammonia, • Urea cycle.

10. Vitamins [5 Hours]

- Definition and classification.
- RDA, sources, coenzyme forms, biochemical functions and disorders for the following watersoluble vitamins: Thiamine, Niacin, Pyridoxine, Cobalamine, Folic acid, Ascorbic acid
- RDA, sources, coenzyme forms, biochemical functions and deficiency disorders for the following fat-soluble vitamins; A and vitamin D.

11. Mineral Metabolism [3 Hours]

- Name the macro/ microminerals
- Iron: Sources, RDA, Functions and Disorders of deficiency and excess
- Calcium and phosphorus: Sources, RDA, functions, normal serum levels and hormones regulating their levels.

12. Nutrition [6 hours]

- Balanced diet (Definition)
- Caloric value; Definition, Caloric values of carbohydrates, proteins and fats
- Total daily caloric requirements of an adult male and female,
- RDA (Definition, standard values for nutrients)
- Basal metabolic rate (BMR); Definition, Magnitude of BMR in men and women, Factors affecting BMR
- Thermic effect/ SDA of food (Definition, values for major macronutrients) • Carbohydrates: Daily dietary requirement.
- Dietary fibers (Definition, functions, importance and their daily requirements)
- Proteins: Daily requirement, Biological value. a. Definition b. Protein used as a standard for this, Protein sources with high and low biological value, Mutual supplementation of proteins (Definition, examples).
- Fats: Daily requirement, Essential fatty acids (Definition, functions, daily requirement and deficiency manifestations), Saturated and unsaturated fatty acids (Definition, sources, examples).
- Malnutrition

13. Renal Function Tests [2 hours]

- Name the different tests to assess the kidney functions
- Explain Creatinine clearance & Inulin clearance
- Urinary acidification test

14. Radioactive Isotopes [1 hour]

- Definition, clinical applications
- Biological effects of radiations

15. Clinical Biochemistry [5 hours]

A. Definitions of acid, base, pH and pKa [1 hour]

B. Buffers • Definition [2 hours]

- Henderson Hasselbalch equation,
- Principal buffer systems in the ECF ICF and urine
- Bicarbonate and phosphate buffer systems (pKa value, normal ratio of base/acid in the plasma)
- Acidosis & Alkalosis: Definition, classification, causes and biochemical findings, Normal serum levels and condition where they are altered **[2 hour]**
- Glucose, Protein, urea, uric acid, and creatinine

- Bilirubin, cholesterol
- Serum Electrolytes

16. Fundamental Chemistry (1 hour)

• Valency, Molecular weight & Equivalent weight of elements and compounds. Normality, Molarity, Molality.

17. Solutions: Definition, use, classification where appropriate, preparation and storage (5 hours)

- Stock and working solutions.
- Molar and Normal solutions of compounds and acids. (NaCl, NaOH, HCl, H2SO4, H3PO4, CH3COOH etc.,)
- Preparation of percent solutions – w/w, v/v w/v (solids, liquids and acids), Conversion of a percent solution into a molar solution
- Saturated and supersaturated solutions
- Standard solutions. Technique for preparation of standard solutions and Storage. E.g: glucose, albumin etc.
- Dilutions- Diluting Normal, Molar and percent solutions. Preparing working standard from stock standard.

ASSIGNMENT TOPICS

1. Units of measurement
2. Hazards - Physical, Chemical, Biological
3. Arterial blood gas analysis
4. Responsibilities of Health care personnel
5. Biomedical waste management

PRACTICAL DEMONSTRATION [20 hours]

- Color Reactions of Carbohydrates & amino acids.
- Precipitation Reactions of proteins
- Colorimetry
- Estimation of Blood glucose Folin Wu and enzymatic method
- Estimation of Urea by DAM method

INTERNAL ASSESSMENT

Theory: Average of 2 exams conducted	-	20
Practical's: Record and lab work*	-	10

*There shall be no university practical examination and internal assessment marks secured in practical's need not be sent to the university.

SCHEME OF EXAMINATION THEORY

There shall be one theory paper of three hours duration carrying 100 marks.

Distribution of type of questions and marks for Biochemistry shall be as given under.

SUBJECTS HAVING MAXIMUM MARKS= 100 (for First year)

Type of Questions	No. of Questions	Marks for Each Questions
Long Essay	2	10
Short Essay	10	05
Short Answer	10	03

1. Long essay- 2 Questions (Second question choice) 2x10= 20 marks
2. Short essay- 10 Questions (Questions no 5 &10 choice) 10x5= 50 marks
3. Short answer- 10 Questions (Questions no 15 & 20 choice) 10x3= 30 marks

Total= 100

Distribution of Marks for University Theory and Practical Exam

Theory				Practical's			Grand Total
Theory	Viva Voce	IA	Sub Total	Practical's	IA	Sub Total	
100	--	20	120	*			**120**

Reference Books

- Biochemistry – 3rd revised edition by U Sathyanarayana & U Chakrapani • Textbook of Medical Biochemistry-6th Edition by MN Chatterjea & Rana Shinde • Textbook of Medical Laboratory technology 2nd edition by Godkar and Godkar.
- Biochemistry-3rd edition by Pankaja Naik
- Medical Laboratory technology 6th edition by Ramnik Sood.
- Manipal Manual of Clinical Biochemistry for medical laboratory and M.Sc., students-3rd edition by Shivananda Nayak B
- Varley's Practical Clinical Biochemistry, 4th, 5th and 6 th editions.

PATHOLOGY

(**Clinical Pathology, Hematology and Blood Banking**)

Theory - 70 hours
Practical's - 20 hours

I. Clinical Pathology- Theory

- Introduction to clinical pathology
- Collection, transport, preservation and processing of various clinical specimens
- Urine examination- collection and preservation, Physical, chemical and microscopic examination for abnormal constituents
- Examination of Body fluids
- Examination of Cerebrospinal fluid (CSF)
- Sputum examination
- Examination of feces

II. Hematology – Theory

- Introduction to hematology
- Normal constituents of Blood, their structure and functions
- Collection of Blood samples
- Various anticoagulants used in Hematology
- Hemoglobin estimation, different methods and normal values
- Packed cell volume
- Erythrocyte sedimentation rate
- Normal Haemostasis
- Bleeding time. Clotting time, prothrombin time, Activated partial Thromboplastin time

III. Blood Bank- Theory

- Introduction blood banking
- Blood group system
- Collection and processing of blood for transfusion
- Compatibility testing
- Blood transfusion reactions

IV. General Pathology:

1. Cell injury:

a. Definition, causes.
b. Cellular adaptations – Hypertrophy, hyperplasia, atrophy and metaplasia.
c. Types of cell injury – Reversible and irreversible; morphology of reversible injury.
d. Necrosis – Definition and patterns of tissue necrosis.
e. Intracellular accumulations – Lipids, cholesterol, proteins, glycogen and pigments; examples.
f. Pathologic calcification – Types and examples.

2. Inflammation:

a. Definition and signs of inflammation.
b. Types – Acute and chronic inflammation.
c. Acute inflammation – Causes, morphological patterns and outcome.
d. Chronic inflammation – Causes, morphology and examples.
e. Regeneration and repair – Mechanism of cutaneous wound healing.
f. Factors affecting wound healing.

3. Hemodynamic disorders:

a. Edema – Definition, pathogenesis and types: Renal, cardiac, pulmonary and cerebral.
b. Difference between transudate and exudate.
c. Shock – Definition, types of shock with examples: Hypovolemic, cardiogenic and septic shock, stages of shock: Nonprogressive, progressive and irreversible.
d. Thrombosis – Definition, mechanism of thrombus formation (Virchow's triad) and fate of thrombus.
e. Embolism – Definition and types: Thromboembolism, fat, air and amniotic fluid embolism. f. Infarction – Definition and examples.

4. Immune system:

a. Autoimmune diseases – General features, enumerate systemic and organ specific autoimmune diseases.
b. Systemic lupus erythematosus – Manifestations and diagnosis.

5. Neoplasia:

a. Definition and nomenclature of tumors.

b. Differences between benign and malignant neoplasms.
c. Enumerate modes of carcinogenesis: Genes, physical, chemical and microbial agents of carcinogenesis.
d. Modes of spread of tumors.
e. Clinical aspects of neoplasia.
f. Grading and staging of cancers.
g. Laboratory diagnosis of cancer.

Practical's

1. Urine analysis- Physical, Chemical, Microscopic
2. Blood grouping and Rh typing
3. Hb estimation, packed cell volume (PCV), Erythrocyte Sedimentation rate (ESR)
4. Bleeding time and Clotting time
5. Histopathology - section cutting and H&E staining.

INTERNAL ASSESSMENT

Theory - Average of 2 exams conducted	20
Practical's: Record and lab work*	10

*There shall be no university practical examination and internal assessment marks secured in practical's need not be sent to the university.

SCHEME OF EXAMINATION THEORY

There shall be one theory paper of three hours duration carrying 100 marks.

Distribution of type of questions and marks for Pathology shall be as given under.

SUBJECTS HAVING MAXIMUM MARKS= 100 (for First year)		
Type of Questions	**No. of Questions**	**Marks for Each Questions**
Long Essay	2	10
Short Essay	10	05
Short Answer	10	03

1. Long essay- 2 Questions (Second question choice) 2x10= 20 marks
2. Short essay- 10 Questions (Questions no 5 &10 choice) 10x5= 50 marks
3. Short answer- 10 Questions (Questions no 15 & 20 choice) 10x3= 30 marks

Total= 100

Distribution of Marks for University Theory and Practical Exam

Theory				Practicals			Grand Total
Theory	Viva Voce	IA	Sub Total	Practicals	IA	Sub Total	
100	--	20	120	*			**120**

REFERENCE BOOKS:

1. Culling Histopathology techniques
2. Bancroft Histopathology techniques
3. Koss- Cytology
4. Winifred Diagnostic cytopathology
5. Orell Cytopathology
6. Todd and Sanford- clinical diagnosis by Laboratory Medicine
7. Dacie and Lewis- Practical Hematology
8. Ramnik SOOD. Lab technology, Methods and interpretation, 4 th edition JP Bros New Delhi, 1996
9. Sathish Guptha, Short textbook of Medical laboratory techniques for technicians
10. Sachdev K N. Clinical Pathology and Bacteriology, 8 th edi JP Bros, New Delhi, 1996.

MICROBIOLOGY

Theory: 70 Hours
Practical's: 20 Hours

1. Introduction (6 hours)

- History of Microbiology - Louis Pasteur, Antony Van Leeuvenhoek, Robert Koch,

  Edward Jenner, Alexander Fleming.
- Use of microscope in the study of bacteria - Types of microscopes - compound microscope, phase contrast microscope, electron microscope, fluorescent microscope, dark ground microscope.
- Morphology of bacterial cell

2. Growth and Nutrition (6 hours)

- Nutrition, growth and multiplication of bacteria, bacterial growth curve, culture media, culture methods, anaerobic culture methods.

3. Sterilization and disinfection (8 hours)

- Principles and use of equipment's of sterilization, chemicals used in disinfection, testing of disinfectants.

4. Biomedical waste management principle and practice 5. Immunology (5hours)

- Immunity - mechanism of immunity, classification, types Vaccines
- Immunization schedule
- Definition of antigen, antibody, list of antigen antibody reaction (no need of detailed account of antigen antibody reactions)
- Definition of hypersensitivity and classification (no need of detailed account of types of hypersensitivity)

6. Infection (5 hours)

- Definition, types and mode of transmission
- Hospital acquired infection - causative agents, mode of transmission and prophylaxis. Antimicrobial sensitivity testing

7. Systematic bacteriology (15 hours)

- Disease caused and laboratory diagnosis of medically important bacteria (Staphylococcus, coagulase negative Staphylococcus, MRSA, Streptococcus pyogenes, Pneumococcus, gonococcus, E.coli, diarrhoeagenic E.coli, Salmonella, Vibrio cholerae, ElTor vibrios, Halophilic vibrios, Shigella, Mycobacterium tuberculosis, Mycobacterium leprae, Atypical Mycobacteria, Treponema pallidum, leptospira)

  (no need of classification, antigenic structure, virulence mechanism)

8. Parasitology (10 hours)

- Introduction to Parasitology
- List of medically important parasites and diseases (E.histolytica, Plasmodium, W.bancrofti, Ascaris, Ancylostoma, B.coli, G.lamblia, T.solium, T.saginata)
- Laboratory diagnosis of parasitic infection (No need of including life cycles)

9. Virology (10 hours)

- Introduction to virology
- List of medically important viruses and diseases (AIDS, Hepatitis, Rabies, Polio, Arbo viruses) Cultivation of viruses and laboratory diagnosis of viral infections.

10. Mycology (5 hours)

- Introduction to Mycology
- Classification of medically important fungi - (based on morphology, spore production, disease production, taxonomy)

- List of medically important fungi and diseases (Candidiasis, Cryptococcosis, Dermatophytes, Aspergillosis, Mucor Mycosis) • Laboratory diagnosis of fungal infections.

Practical's (20 hours)

- Compound microscope (Demonstration) Demonstration of sterilization equipment's
- Demonstration of culture media and culture methods
- Demonstration of antibiotic sensitivity testing
- Demonstration of serological tests - Widal, VDRL, ASO, CRP, RA
- Demonstration of gram stain and ZN staining
- Demonstration of Helminthic ova Grams stain, Acid fast staining Stool exam for Helminthic ova

There shall be no university practical examination and Internal Assessment marks secured in practical's need not be sent to the university.

INTERNAL ASSESSMENT

Theory - Average of 2 exams conducted 20 **Practical's:** Record and lab work* 10

SCHEME OF EXAMINATION THEORY

There shall be one theory paper of three hours duration carrying 100 marks.

Distribution of type of questions and marks for Microbiology shall be as given under.

SUBJECTS HAVING MAXIMUM MARKS= 100 (for First year)		
Type of Questions	**No. of Questions**	**Marks for Each Questions**
Long Essay	2	10
Short Essay	10	05
Short Answer	10	03

1. Long essay- 2 Questions (Second question choice) 2x10= 20 marks
2. Short essay- 10 Questions (Questions no 5 &10 choice) 10x5= 50 marks
3. Short answer- 10 Questions (Questions no 15 & 20 choice) 10x3= 30 marks

Total= 100

Distribution of Marks for University Theory and Practical Exam

Theory				**Practical's**			**Grand Total**
Theory	Viva Voce	IA	Sub Total	Practical's	IA	Sub Total	
100	--	20	120	*			**120**

Reference Books-

1. Ananthanarayana & Panikar Medical Microbiology- University Press

2. Robert Cruckshank- Medical Microbiology- The Practice of Medical Microbiology
3. Chatterjee- Parasitology- Interpretation to Clinical Medicine
4. Rippon- Medical Mycology
5. Emmons- Medical Mycology
6. Basic Laboratory methods in Parasitology, J P Bros, New Delhi
7. Basic Laboratory procedures in clinical bacteriology, J P Bros, New Delhi
8. Medical Parasitology- Ajit Damle **9.** Introduction to medical microbiology- Ananthanarayana- Orient Longman Pvt. Ltd.

SUBSIDIARY SUBJECTS

ENGLISH

COURSE DESCRIPTION: This course is designed to help the student acquire a good command and comprehension of the English language through individual papers and conferences.

BEHAVIOURAL OBJECTIVES:

The student at the end of training can

1. Read and comprehend English language

2. Speak and write grammatically correct English

3. Appreciates the value of English literature in personal and professional life.

UNIT - I: INTRODUCTION:

- Study Techniques
- Organization of effective note taking and logical processes of analysis & synthesis
- Use of the dictionary
- Enlargement of vocabulary
- Effective diction

UNIT - II: APPLIED GRAMMAR:

- Correct usage
- The structure of sentences
- The structure of paragraphs
- Enlargements of Vocabulary

UNIT - III: WRITTEN COMPOSITION:

- Precise writing and summarizing
- Writing of bibliography
- Enlargement of Vocabulary

UNIT - IV: READING AND COMPREHENSION:

- Review of selected materials and express oneself in one's words.
- Enlargement of Vocabulary.

UNIT - V: THE STUDY OF THE VARIOUS FORMS OF COMPOSITION:

- Paragraph, Essay, Letter, Summary, Practice in writing

UNIT - VI: VERBAL COMMUNICATION:

- Discussions and summarization, Debates, Oral reports, use in teaching

Scheme of Examination

Written (Theory): Maximum Marks: –80 marks.

SUBJECTS HAVING MAXIMUM MARKS= 80 (for First year)		
Type of Questions	**NO. of questions**	**Marks for Each Questions**
Essay Type	3 (2 x 10)	10
Short Essay Type	8 (6 x 5)	05
Short Answer Type	12 (10 x 3)	03

The mark distributions for all the subjects are as follows:

1. Long essay - 2 Questions 2x 10=20 marks
2. Short essay - 6 Questions 6x 5= 30 marks
3. Short answer - 10 Questions 10x 3= 30 marks

Total=80 marks

No Practical or Viva voce examination.

This is a subsidiary subject, examination to be conducted by respective colleges.

Marks required for a pass is 35%.

REFERENCE

- English Grammar Collins, Birmingham University, International Language Data Base, Rupa & Co. 1993
- Wren and Martin - Grammar and Composition, 1989, Chanda & Co, Delhi
- Letters for all Occasions. A S Myers. Pub - Harper Perennial
- Spoken English V. Shasikumar and P V Dhanija. Pub. By: Tata Mcgraw Hill, New Delhi
- Journalism Made Simple D Wainwright
- Writers Basic Bookself Series, Writers Digest series
- Interviewing by Joan Clayton Platkon
- Penguin Book of Interviews.

HEALTH CARE

Teaching Hours: 40

- Introduction to Health
- Definition of Health, Determinants of Health, Health Indicators of India, Health Team Concept.
- National Health Policy
- National Health Programs (Briefly Objectives and scope) Population of India and Family welfare program in India Introduction to Nursing
- What is Nursing? Nursing principles. Inter-Personnel relationships. Bandaging: Basic turns; Bandaging extremities; Triangular Bandages and their application.
- Nursing Position, Bed making, prone, lateral, dorsal, dorsal re-cumbent, Fowler's positions, comfort measures, Aids and rest and sleep.

- Lifting and Transporting Patients: Lifting patients up in the bed. Transferring from bed to wheelchair. Transferring from bed to stretcher.
- Bed Side Management: Giving and taking Bed pan, Urinal: Observation of stools, urine. Observation of sputum understand use and care of catheters, enema giving.
- Methods of Giving Nourishment: Feeding, Tube feeding, drips, transfusion Care of Rubber Goods
- Recording of body temperature, respiration and pulse, Simple aseptic technique, sterilization and disinfection. Surgical Dressing: Observation of dressing procedures First Aid:
- Syllabus as for Certificate Course of Red Cross Society of St. John's Ambulance Brigade.

Reference Books:

- Preventive and Social Medicine by J.Park Text Book of P & SM by Park and Park
- Counseling& Communicate skills for medical and health, Bayne- Orient Longman Pvt. Ltd.

Scheme of Examination

Written (Theory): Maximum Marks: – **80 marks.**

SUBJECTS HAVING MAXIMUM MARKS= 80 (for First year)		
Type of Questions	**NO. of questions**	**Marks for Each Questions**
Essay Type	3 (2 x 10)	10
Short Essay Type	8 (6 x 5)	05
Short Answer Type	12 (10 x 3)	03

The mark distributions for all the subjects are as follows:

1. Long essay - 2 Questions 2x 10=20 marks
2. Short essay - 6 Questions 6x 5= 30 marks
3. Short answer - 10 Questions 10x 3= 30 marks

Total=80 marks

No Practical or Viva voce examination.

This is a subsidiary subject, examination to be conducted by respective colleges.

Marks required for a pass is 35%.

II Year B.Sc. Medical Imaging Technology

COURSE TITLE

Theory

- Radiation Physics: Medical Physics & Radiation Safety in Radio Diagnosis
- Imaging Physics & Dark Room Techniques
- Radiographic Positioning and Techniques

Practical

- Imaging Physics & Dark Room Technique

RADIATION PHYSICS: MEDICAL PHYSICS & RADIATION SAFETY IN RADIO DIAGNOSIS

No. of Theory Classes: 100 Hours

SECTION-A
RADIATION PHYSICS

Unit	Topics	No. of Hours	Mode of Teaching
1.	**Atomic and Nuclear Physics Review of Ideas on Atomic and Nuclear Physics** • Review of ideas on atomic and nuclear physics • Alpha decay, beta decay gamma emission • Internal conversion and nuclear isomerism • Nuclides and its classification • Radio activity • Half life	**3**	Lecture Discussion Presentation
2.	**Electromagnetic Radiation** • Electromagnetic spectrum • Common properties of electromagnetic radiation • Relationship between energy, frequency, wavelength and velocity e.g., x- ray and gamma rays	**4**	Lecture Discussion Presentation

3.	**Review of X-Rays** • Properties of X-rays • Production of X-rays • Interaction of X-rays with the target • Spectra of X-rays • Quality and intensity of X-rays • The factors influencing quality and intensity	**5**	Lecture Discussion Presentation
4.	**Interactions of X-Rays, Gamma Rays and Beta Rays with Matter** • Transmission through matter • Law of exponential attenuation • Half value layer • Linear attenuation coefficient • Interaction of radiation with matter • Classical scattering • Compton scattering • Photo electric absorption • Pair production • Practical aspects of radiation absorption and transmission through body tissue.	**7**	Lecture Discussion Presentation

MEDICAL PHYSICS

Unit	Topics	No. of Hours	Mode of Teaching
1.	**Main Power Supply** • Generation of Electrical Energy • Distribution of Electrical Energy • Generators and transformers • AC and DC power supply with examples • Single phase and poly phase power supply • Switches, fuses, circuit breakers, earthing etc. • Main voltage drop: causes and remedy • Low- and high-tension Cables	7	Lecture Discussion Presentation
2.	**Rectification** • Vacuum diode- variation of anode current with anode voltage and filament temperature • Gas filled diode and triode • Principles of rectification • Wave form of half wave and full wave current/voltage wave form • Rectifiers: valves, metal rectifiers, semiconductor rectifiers and relative merits and demerits • Diodes	6	Lecture Discussion Presentation

3.	**X- Ray Circuits** • Principle of transformers, design efficiency of transformer, source of power loss • H.T generators for x-ray machines • High frequency circuits • Self-rectifier half wave rectifier, bridge rectifier and three phase rectifier circuits • Capacitance filter control and stabilizing equipment • Main voltage compensators and main resistance compensators • Compensation for frequency variation • Control of tube voltage, including kV compensator • High tension selector switch • Filament circuit • Control of tube current, space charge compensation	7	Lecture Discussion Presentation
4.	**X- Ray Tube** • Gas filled x-ray tube: construction, working and limitations; thermionic emission • Stationary anode x-ray tube: construction, working, methods of cooling anode; rating chart and cooling chart • Rotating anode x-ray tube: construction, working &	7	Lecture Discussion Presentation

	rating chart, speed of anode rotation, angle of anode inclination • Dual focus with consideration in choice of focus • Anode heel effect • Grid controlled x-ray tube • Effect of variation of anode voltage and filament temperature • Continuous and characteristic spectrum of x-rays • Inherent filter and added filter; their effect on quality of the spectrum		
5.	**Modern x-ray tubes** • Types in detail	4	Lecture Discussion Presentation
6.	**Filters** • Definition of filtration • Types of filtration and their effect on quality of the spectrum • Effect of filtration on patient as well as exposure factor • Types of filters	5	Lecture Discussion Presentation
7.	**X- ray beam restrictors** • Definition • Functions of restrictors • Radiation protection considerations	5	Lecture Discussion Presentation

8.	**Grids** • Definition and types • Evaluation of grid performance • Grid cut-off • Air gap technique	4	Lecture Discussion Presentation
9.	**Fluoroscopy** ***Image intensifier*** • Direct fluoroscopy • Principles of image intensification • Image quality: unsharpness, noise, resolution, distortion • Spectral emission; gas spots • Multi field image intensifiers • Lens system and image distribution • Viewing and recording of fluoroscopic image	6	Lecture Discussion Presentation

RADIATION SAFETY IN RADIO DIAGNOSIS

Unit No.	Topic	No. of Hours	Mode of teaching
1.	**Introduction 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 factor.	5	Lecture Discussion Presentation
2.	**Limits for Radiation exposure** • Concept of ALARA (or ALARP) • ICRP regulation • Maximum permissible dose • Exposure in pregnancy, children	4	Lecture Discussion Presentation
3.	**Protection in Diagnostic Radiology** • Protection for primary radiation • Work load • Use factor • Occupancy factor • Protection for scatter radiation and leakage radiation • X-Ray room design • Structural shielding • Protective devices • Radiation signages	5	Lecture Discussion Presentation

4.	**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	6	Lecture Discussion Presentation
5.	**Radiation measuring instruments** • Area monitoring • Ionization chamber • G M counter • Scintillation detector • Photo film method • Pocket dosimeter • Personnel dosimeters	5	Lecture Discussion Presentation
	• Film badge • TLD • Solid state detectors • Chemical dosimeters • Exposure meters and rate meters • Measurement of half value layer		
6.	**Biological aspects of Radiological protection** • Direct & Indirect actions of radiation • Concept of detriment – Deterministic & stochastic effect of radiation – somatic and genetic effects.	5	Lecture Discussion Presentation

Scheme of examination:

Theory

There shall be one theory paper of three hours duration carrying 100 marks.

Distribution of type of questions and marks for the subject shall be as given under.

SUBJECTS HAVING MAXIMUM MARKS= 100		
Type of Questions	**No. of Questions**	**Marks for Each Questions**
Long Essay	2	10
Short Essay	10	05
Short Answer	10	03

1. Long essay- 2 Questions (Second question choice) 2x10= 20 marks
2. Short essay- 10 Questions (Questions no 5 &10 choice) 10x5= 50 marks
3. Short answer- 10 Questions (No choice) 10x3= 30 marks

Total= 100

Reference Books:

1. Christinsen, Curry and Dowdey: An Introduction of The Physics of Diagnostic Radiology (Lea Febiger) 2nd Ed.
2. D.N. And M.O. Chesney, X-Ray Equipment for Student Radiographers (Cbs)
3. W.J. Meredith & J.B. Massey: Fundamental Physics of Radiology. (Varghese Publishing House). **4.** Faiz M. Khan, Physics of Radiation Therapy (Williams & Wilkins)
4. S.S. Kapoor &Ramamoorthy; Nuclear Radiation Detectors.

IMAGING PHYSICS AND DARKROOM TECHNIQUES

No. of Theory Classes: 80 Hours

Unit No.	Topics	No. of Hours	Mode of teaching
1.	**Image Characteristics** • Definition • Reflected, transmitted and emitted light image • Noise (fog, quantum noise), SNR, contrast, optimum contrast, sharpness • Resolution	4	Lecture Discussion Presentation
2.	**Radiographic Image Quality** • Density • Noise • Contrast • Sharpness • Resolution • Magnification & Distortion **Exposure Factors** • Milliampere seconds • Kilovoltage • Focus to film distance • Secondary radiation Grids	4	Lecture Discussion Presentation
3.	**The invisible X-ray image** • Latent image • Subject contrast • Differential attenuation • Effects of scatter and its control • Geometric & motion unsharpness	4	Lecture Discussion Presentation

4.	**Photographic principle** • Photographic effect • Photosensitive chemicals: latent image formation • Manufacture of emulsion: light and x-ray sensitive emulsion • Describing photographic performance: density, log relative exposure • The characteristic curve • Sensitometry	4	Lecture Discussion Presentation
5.	**The recording system: film material** • Film construction • Film base, subbing layer, emulsion, super coat, backing layers • Crossover effect; irradiation • Types of films • Screen & Non-screen films • Single emulsion films • Duplitized films	4	Lecture Discussion Presentation

	• CRT films • Film storage		
6.	**The recording system: intensifying screens** • Luminescence • Screen unsharpness • Screen construction • Phosphors • Quantum detection & conversion efficiency • Types of screen • Intensifying factor: quantum mottle • Factors affecting speed and unsharpness • Care of screens	4	Lecture Discussion Presentation
7.	**The recording system: film cassettes** • Cassette construction and ideal features • Types of cassettes • Care of cassettes; loading and unloading cassettes • Special cassettes	4	Lecture Discussion Presentation
8.	**Factors effecting image quality** • Radiographic image. • Geometry of the radiographic image	4	Lecture Discussion Presentation
9.	**The processing area** • Siting and function of the processing area • Darkroom design and construction • Darkroom illumination • Darkroom equipments: manual & automatic processors • Health and safety in Dark room • COSHH regulations	4	Lecture Discussion Presentation
10.	**Photographic processing: Principles -1 (Manual Processing)** • Acidity, alkalinity and pH • Development: • Developer solution & activity • Fixing: fixing solution and activity • Washing & Drying	6	Lecture Discussion Presentation

11.	**Photographic processing: principles - 2 (Auto processors)** • Film transport, cycle time, capacity • Feed section • Developer section • Fixer section • Washing section • Drying section • Stand by mode • Replenishment; auto mixers • Auto processors for special films • Care & maintenance of the auto processors	6	Lecture Discussion Presentation
12.	**Silver recovery** • Justification for silver recovery • Amounts of silver in fixer • Electrolytic recovery; high current systems • Recovering silver deposit; recycling fixer • Monitoring efficiency; comparison of methods • Silver recovery from scrap films	4	Lecture Discussion Presentation
13.	**Film artifacts** • Definition • Causes • Types	4	Lecture Discussion Presentation
14.	**Macro radiography** • Definition • Principle • Unsharpness • Scattered radiation • Cassette support • Examples of macro radiography	4	Lecture Discussion Presentation

Scheme of Examination:

Theory

There shall be one theory paper of three hours duration carrying 100 marks.

Distribution of type of questions and marks for the subject shall be as given under.

SUBJECTS HAVING MAXIMUM MARKS= 100		
Type of Questions	**No. of Questions**	**Marks for Each Questions**
Long Essay	2	10
Short Essay	10	05
Short Answer	10	03

1. 1. Long essay- 2 Questions (Second question choice) 2x10= 20 marks
2. Short essay- 10 Questions (Questions no 5 &10 choice) 10x5= 50 marks
3. Short answer- 10 Questions (No choice) 10x3= 30 marks

Total= 100

Practical

There shall be a university practical examination in the subject of Imaging Physics and Darkroom Techniques for 100 marks.
The internal assessment is for 20 marks.

Pattern for Practical Examination:

Sl. No.	Particulars	Marks
1	Practical Exercise	40
2	Viva-Voce	40
Total		**80**

Reference books:

1. D.N. Chesney & M.O Chesney: radiographic imaging (CBS)
2. I.C.R.P.: Protection of the patient in medical radiography (Bergaman)
3. Derrick p. Roberts &nigel l. Smith: radiographic imaging a practical approach (Churchill Uvingstone)
4. Stewart c. Buchong: radiological science (workbook and laboratory manual)
5. Kodak: fundamentals of radiographic photography books 1,2,3,4,5 (kodak ltd.)
6. Seeman &herman: physical and photography principles of medical radiography (Wiley)
7. Hford: Manual of photography Bouthworth&bently: elementary photogenic chemistry (pitmans)

RADIOGRAPHIC POSITIONING AND TECHNIQUES

No. of Theory Classes: 100 Hours
No. of Practical Classes: 300 Hours

Unit No.	Topics	No. of Hours	Mode of teaching
1.	**Introduction** • Anatomical Terminology • Positioning Terminology • Projection Terminology	2	Lecture Discussion Presentation

2.	**Shoulder girdle** • Related radiological anatomy **Basic and special projections** ***Shoulder non-trauma routine*** • AP (external rotation) • AP (internal rotation) • Superior-inferior (axial view) • Inferio-superior axial (Lawrence method) • Inferio-superior shoulder projection (west point method) • Posterior oblique – glenoid cavity (grashey method) • Intertubercular groove (fisk method) ***Shoulder (trauma routine)*** • AP neutral rotation • Transthoracic lateral (Lawrence method) • Tangential projection - supraspinatus outlet (neer method) • Apical oblique projections (garth method) • Clavicle • AP and AP axial • Acromioclavicular joints: • AP bilateral with and without weight • Sternoclavicular joints (PA, RAO, LAO) • Scapula • AP • Scapula Y view • Lateral recumbent	8	Lecture Discussion Presentation
3.	**Humerus** • Related radiological anatomy • AP • LAT • Horizontal beam LAT • Proximal humerus views	2	Lecture Discussion Presentation
4.	**Elbow** • Related radiological anatomy • AP- fully extended, partially flexed • AP oblique- external and internal rotation • Lateral • Acute flexion (jones method) • Trauma axial lateral (coyle method) • Radial head lateral	2	Lecture Discussion Presentation
5.	**Forearm** • Related radiological anatomy • AP • LAT	8	Lecture Discussion Presentation

6.	**Wrist** • Related radiological anatomy • PA, AP • PA oblique • Lateral • PA scapula views • Radial deviation, ulnar deviation • Carpal canal- inferiosuperior (gaynor-hart method) • Carpel bridge	4	Lecture Discussion Presentation
7.	**Hand** • Related radiological anatomy • PA • PA oblique • Lateral • Lateral- flexion and extension • AP bilateral oblique (norgaard method)	2	Lecture Discussion Presentation
8.	**Fingers** • Related radiological anatomy • PA • Oblique • LAT	2	Lecture Discussion Presentation
9.	**Thumb** • Related radiological anatomy • AP • PA oblique • Lateral • AP (Roberts method) • Skiers thumb (folio method)	2	Lecture Discussion Presentation
10.	**Femur** • Related radiological anatomy • Mid and distal femur • AP • Lateral • Mid and proximal femur • AP • Lateral	2	Lecture Discussion Presentation
11.	**Knee** • • Related radiological anatomy • • Knee • • AP • • Oblique- medial and lateral rotations • Lateral • Skyline view • AP (weight bearing) Knee- intercondylar fossa PA axial (camp coventry and holmblad method) AP axial	2	Lecture Discussion Presentation

12.	**Leg** • Related radiological anatomy • AP LAT	2	Lecture Discussion Presentation
13.	**Ankle** • Related radiological anatomy • AP • AP mortise (15° oblique) Lateral AP stress	2	Lecture Discussion Presentation
14.	**Foot** • Related radiological anatomy • AP • Oblique Lateral AP and lateral weight bearing	2	Lecture Discussion Presentation
15.	**Calcaneus** • Related radiological anatomy • Planto-dorsal (axial) • Lateral	2	Lecture Discussion Presentation
16.	**Pelvic girdle and proximal femur** • Related radiological anatomy ***Basic & special projections*** • Pelvic girdle • AP pelvis • Frog lateral (modified cleaves method) • AP axial for pelvic outlet (tayelor method) • AP axial for pelvic inlet (modified linienfield method) • Posterior oblique- acetabulum (judet method) • Hip and proximal femur • AP unilateral hip • Axiolateral, inferosuperior (danelius – miller method) • Unilateral frog leg (modified cleaves method) • Modified axiolateral (clements-nakayama method) • Sacrioiliac joints: AP, posterior obliques	6	Lecture Discussion Presentation

17.	**Chest** • Related radiological anatomy ***Basic & special projections*** • PA, LAT ***Special:*** • AP supine &semierect • Lateral decubitus • AP lordotic • Anterior oblique • Posterior oblique • Upper airway: AP, LAT	6	Lecture Discussion Presentation

18.	**Abdomen** • Related radiological anatomy • Basic & special projection • Basic: • AP supine (KUB) • Special: • PA prone • Lateral decubitus • Erect AP • Dorsal decubitus • Lateral • Acute abdomen: three-way series	6	Lecture Discussion Presentation
19.	**KUB** • Related radiological anatomy • Positioning- AP/Lat	3	Lecture Discussion Presentation
20.	**Cervical spine** • Related radiological anatomy • Basic views • AP open mouth (C1 and C2) • AP axial • Oblique • Lateral • Erect • Trauma lateral (horizontal beam) • Cardiothoracic junction (swimmers view) • Special views • Lateral- hyperflexion and hyperextension • AP (fuchs method) or PA (judd method) • AP wagging jaw (ottonello method)	8	Lecture Discussion Presentation

	• AP axial (pillars)		
21.	**Thoracic spine** • Related radiographic anatomy • AP • Lateral • Oblique	4	Lecture Discussion Presentation

22.	**Lumbar spine, sacrum and coccyx** • Related radiographic anatomy • Lumbar spine • AP • Oblique • Lateral • Lateral (L5 - S1) • AP axial (L5 - S1) • Scoliosis series • AP or PA • Erect lateral • AP (Ferguson method) • AP - R and L bending • Spinal fusion series • AP or PA - R and L bending • Lateral - hyperextension and hyperflexion • Sacrum and Coccyx • AP axial sacrum • AP axial coccyx • Lateral sacrum • Lateral coccyx	8	Lecture Discussion Presentation
23.	**Pediatric radiography** • Positioning, care and radiation protection while handling babies	2	Lecture Discussion Presentation
24.	**Skull and cranial bones and facial bones** • Related radiological anatomy • Basic & special projections • Cranium • Base of skull • Sella turcica • Mastoids • Optic foramina and Orbits • Nasal bone • TM joint • Facial bone • Zygomatic arches • Mandible • Para nasal sinuses	8	Lecture Discussion Presentation
25.	**Neck** • Related radiological anatomy • Positioning- AP, LAT	2	Lecture Discussion Presentation
26.	**Dental radiography** • Introduction • Terminology • Dental formula • Intra – oral radiography • Bite wing • Periapical radiography • Occlusal radiography • Extra oral oblique lateral • Cephalometry • Orthopantomography	3	Lecture Discussion Presentation

Scheme of Examination:

Theory:

There shall be one theory paper of three hours duration carrying 100 marks.
The marks for internal assessment is 20 marks.

Distribution of type of questions and marks for the subject shall be as given under.

SUBJECTS HAVING MAXIMUM MARKS= 100		
Type of Questions	**No. of Questions**	**Marks for Each Questions**
Long Essay	2	10
Short Essay	10	05
Short Answer	10	03

1. Long essay- 2 Questions (Second question choice) 2x10= 20 marks
2. Short essay- 10 Questions (Questions no 5 &10 choice) 10x5= 50 marks
3. Short answer- 10 Questions (No choice) 10x3= 30 marks

Total= 100

There shall be no University Practical Examination in Second year in the subject of Radiographic Positioning & Techniques.

There shall be a university practical examination in third year in the subject of Radiographic Positioning and Special Procedures for 100 marks.

III Year BSc. Medical Imaging Technology

COURSE TITLE

Theory

- Diagnostic Imaging Techniques & Modalities
- Radiographic Special Procedures and Patient Care

Practical

- Diagnostic Imaging Techniques & Modalities
- Radiographic Positioning and Special Procedure

DIAGNOSTIC IMAGING TECHNIQUES & MODALITIES

No. of Theory Classes: 200 Hours
No. of Practical Classes: 300 Hours

UNIT No.	Topics	No. of Hours	Mode of teaching
PART-A	**COMPUTED TOMOGRAPHY**		
1.	**Introduction to CT** • History • Advantage of CT • Comparisons with other imaging modalities	2	Lecture Discussion Presentation
2.	**CT principle** • Basic principle • CT number	2	Lecture Discussion Presentation
3.	**CT generations** • First generation • Second generation • Third generation • Fourth generation • Slip ring technology • Electron beam CT • Multi slice technology	3	Lecture Discussion Presentation
4.	**CT detector** • Types • Construction • Comparison • Detector Cross talk	2	Lecture Discussion Presentation
5.	**Image reconstruction** • Basic principle • Image reconstruction from projections • Reconstruction algorithms • Types of data	3	Lecture Discussion Presentation
6.	**Instrumentation** • CT scanner • Imaging system • CT computer and image processing • Image display, storage, recording and communications • CT control console • Options and accessories for CT systems	4	Lecture Discussion Presentation
7.	**Data acquisition** • Basic scheme for data acquisition • CT detector technology • Detector electronics • Data acquisition and sampling	3	Lecture Discussion Presentation

8.	**Image display** • Image formation and representation • Image processing • Pixel and voxel • CT number • Window level and window width	3	Lecture Discussion Presentation
9.	**CT Artifacts** • Classification • Types • Causes • Remedies	3	Lecture Discussion Presentation
10.	**Image quality** • Qualities • Resolution • Contrast • Sharpness • Noise properties in CT	2	Lecture Discussion Presentation
11.	**Basic diagnostic aspects** • Role of the CT technologist • Patient management • Indication • Patient preparation • Patient positioning and scanning protocols	2	Lecture Discussion Presentation
12.	**CT contrast media** • Types • Use and administration • Contraindications	2	Lecture Discussion Presentation
13.	**CT guided procedures** • Protocols • Both invasive and non- invasive	2	Lecture Discussion Presentation
14.	**Safety consideration** • Staff safety • Patient safety • Universal precautions • Knowledge of communicable and non-communicable diseases	2	Lecture Discussion Presentation
15.	**Documentation** • Role of CT Technologist • Documentation of information about patient care, the procedure and the final outcome	1	Lecture Discussion Presentation
PART-B	**ULTRASONOGRAPHY**		

1.	**Introduction to Ultrasound Imaging** • Ultrasound imaging • Doppler imaging • Basic principle • Advantages and disadvantages **Ultrasound** • Sound • Ultrasound • Attenuation • Echoes	3	Lecture Discussion Presentation
2.	**Instrumentation** • Knowledge of console and keys • CRT • USG probes • Coupling agent • Contrast agents used	4	Lecture Discussion Presentation
3.	**Piezoelectric effect** • Definition • Types of elements • Properties • Use	3	Lecture Discussion Presentation
4.	**Transducers** • Construction and operation • Types • Beams and focusing • Resolution		Lecture Discussion Presentation
5.	**USG display** • A mode • B mode • M mode • TM mode • Gray scale imaging • Time gain compensator	3	Lecture Discussion Presentation
6.	**Doppler** • Principle • Doppler effect • Flow	4	Lecture Discussion Presentation
7.	**Instrumentation** • Color Doppler • Continuous wave Doppler • Pulsed wave Doppler	3	Lecture Discussion Presentation
8.	**Artifacts** • Definition • Types • Causes • Remedies	3	Lecture Discussion Presentation

10.	**Performance and safety** • Performance measurement • Bioeffects • Safety	3	Lecture Discussion Presentation
11.	**Practical aspect** • Scanning protocols • Indications • Patient preparation • Positioning • Knowledge of all USG guided procedures	4	Lecture Discussion Presentation
PART-C	**NUCLEAR MEDICINE IMAGING**		
1.	**Introduction & History**	1	Lecture Discussion Presentation
2.	**Basic atomic & nuclear physics** • Quantities and Units • Atom composition and structure • Nucleus composition • Radioactivity • Exponential decay • Parent / Daughter decay • Modes of Radioactive decay	10	Lecture Discussion Presentation
3.	**Introduction to radiopharmaceuticals** • Ideal features of Radiopharmaceutical • General principle of tracer technique	6	Lecture Discussion Presentation
4.	**Radiation safety in Nuclear medicine** • Safe handling of Radioactive • Storage of radioactive materials • Procedures for handling spills • Disposal of Radioactive waste	6	Lecture Discussion Presentation
5.	**Gamma Camera**	2	Lecture Discussion Presentation
6.	**PET**	2	Lecture Discussion Presentation
7.	**SPECT**	2	Lecture Discussion Presentation

8.	**Radiation monitoring** • Survey meters • Personnel dosimeters • Wipe testing • Contamination monitor • Isotope calibrator • Area monitor • Inventory of isotopes	6	Lecture Discussion Presentation
9.	**Construction and layout of nuclear medicine department**	3	Lecture Discussion Presentation
10.	**In vivo technique** • Static and dynamic studies • Thyroid imaging • Imaging of bone • Respiratory system • Urinary system • G.I. system • Cardiovascular system • Iodine131 uptake studies • Iodine 131 therapy for thyrotoxicosis and thyroid ablation	9	Lecture Discussion Presentation
PART D			
1.	**Computed Radiography** • Introduction • Components • Cassettes and Imaging plates • Digitizer • Image formation • Advantages and disadvantages	4	Lecture Discussion Presentation
2.	**Digital Radiography** • Introduction • Work flow • System components • Image formation • Advantages and disadvantages	4	Lecture Discussion Presentation
3.	**PACS** • Introduction • Work flow • Components • Types • Storage Advantages and disadvantages	3	Lecture Discussion Presentation
4.	**DSA** • Introduction • Room layout and design • Equipment • Image recording system	6	Lecture Discussion Presentation

	• Automatic injection devices • Contrast media • Catheters and accessories • Subtraction techniques		
5.	**Mammography** • Introduction • Physics involved in it • Patient preparation • Different techniques	4	Lecture Discussion Presentation
PART- E	**MAGNETIC RESONANCE IMAGING**		
1.	**Basic principle** • Introduction • Atomic structure • Motion within the atom • The hydrogen nucleus, alignment • Precession • Larmor equation • Resonance • MR signal • Free induction decay signal • Relaxation • T1 recovery • T2 decay • Pulse timing parameters	4	Lecture Discussion Presentation
2.	**Encoding and image formation** • Introduction • Gradients • Slice selection • Frequency encoding • Phase encoding • Sampling	3	Lecture Discussion Presentation
3.	**Data collection and image formation** • Introduction • K space • Fast fourier transformation • Matrix • Scan timing • K space filling • Partial or fractional echo imaging & averaging • Pre- scan • Types of acquisition	3	Lecture Discussion Presentation
4.	**Parameters and trade- offs** • Introduction • Signal to Noise Ratio (SNR) & How to increase SNR • Contrast to Noise Ratio (CNR) • Spatial resolution & how to increase the spatial resolution	4	Lecture Discussion Presentation

	• Scan time & how to reduce time • Trade-offs • Decision making • Volume imaging		
5.	**Pulse sequences** • Introduction	3	Lecture Discussion Presentation
6.	**Spin echo sequences** • Conventional spin echo • Fast spin echo • Inversion recovery • STIR • FLAIR	4	Lecture Discussion Presentation
7.	**Gradient echo pulse sequences** • Conventional gradient echo • The steady state • Coherent gradient echo • Incoherent gradient echo • Balance gradient echo • SSFP • Ultra- fast sequences • EPI	5	Lecture Discussion Presentation
8.	**Flow phenomena** • Introduction • The mechanisms of flow • Time of flight phenomenon • Entry slice phenomenon • Intra- voxel dephasing	3	Lecture Discussion Presentation
9.	**Flow phenomena compensation** • Introduction • Gradient moment rephrasing • Pre-saturation • Even echo rephrasing	3	Lecture Discussion Presentation
10.	**Artifacts and their compensation** • Introduction • Phase mis-mapping • Aliasing or wrap around • Chemical shift artifact • Chemical misregistration • Truncation artifact • Magnetic susceptibility artifact • Zipper artifact • Shading artifact • Motion of the patient • Cross excitation and cross talk	4	Lecture Discussion Presentation

11.	**Instrumentation and Equipment's** • Introduction • Magnetism • Permanent magnets • Electromagnets • Super conducting magnets • Fringe fields • Shim coils • Gradient coils • Radio-frequency coils • The pulse control units • Patient transportation system • Operator interface	6	Lecture Discussion Presentation
12.	**Vascular and cardiac imaging** • Introduction • Conventional vascular imaging techniques • MRA • Perfusion and diffusion imaging • Cardiac imaging • Peripheral gating • Pseudo-gating • Multi-phase cardiac imaging • Cine • SPAMM	5	Lecture Discussion Presentation
13.	**MR safety** • Introduction • MRI Environment • Safety from main magnetic field • Safety from varying magnetic field (gradient) • Safety from Radio frequency field • Projectiles • Medical emergencies • Implants and prostheses • Claustrophobia • Quenching • Safety education • Patient monitoring • Monitors and devices in MRI • MRI personnel • Safety tips • Site planning	5	Lecture Discussion Presentation
14.	**Contrast agents in MRI** • Introduction • Uses and methodology • Review of weighting • Mechanism of action • Dipole-dipole interactions • Magnetic susceptibility • Relaxivity	3	Lecture Discussion Presentation
	• Gadolimium safety • Feridex safety • Current applications of contrast agents		

15.	**Advanced imaging techniques** • Introduction • High speed gradient system • Developments in fast spin echo • Developments in gradient echo • Applications of echo planar imaging • Spectroscopy • Diffusion imaging • Perfusion imaging • Functional imaging • Interventional MRI	4	Lecture Discussion Presentation
16.	**MRI Imaging protocol** • Brain • Neck • Heart • Abdomen • Pelvis • Extremities • Spine	4	Lecture Discussion Presentation

Scheme of Examination

Theory:

There shall be one theory paper of three hours duration carrying 100 marks.

Distribution of type of questions and marks for Diagnostic Imaging Techniques & Modalities shall be as given under.

SUBJECTS HAVING MAXIMUM MARKS= 100		
Type of Questions	**No. of Questions**	**Marks for Each Questions**
Long Essay	2	10
Short Essay	10	05
Short Answer	10	03

1. Long essay- 2 Questions (Second question choice) 2x10= 20 marks
2. Short essay- 10 Questions (Questions no 5 &10 choice) 10x5= 50 marks
3. Short answer- 10 Questions (No choice) 10x3= 30 marks

Total= 100

Reference Books:

1. R.F. Fatr& P.J. Ahisy: Physics for Medical Imaging (Saunders)
2. D.N. Chesney & M.O. Chesney: X-Ray Equipment for Student Radiographers (CBS)
3. Christensen, Curry &Dowdey: An Introduction of Physics to Diagnostic Radiography (Lea &Febiger)
4. Cullinan: Illustrated Guide Techniques (Blackwell)
5. Jamdrell, Thompson & Ashworth: X-Ray Physics and Equipment (Blackwell)
6. Adrian K.Dixon : Body C.T. - A Handbook (Churchill Livingstone)
7. John M. Stevens, Alan R. Valentine & Brian E. Kendall: Computed Cranial & Spinal Imaging (Williams & Wilkins)
8. John R. Haaga, Charles F. Lanzion, David J. Sartoris & Elias A.Aerhouni . Computerised 9. Tomography and Magnetic Resonance Imaging of The Whole Body (Vol.1 & Ii) (Saunders).
10. Philip T. English & Christine Moore: Mri For Radiographers (Springer)
11. Pablo R.Ros& W. Dean Bidgood : Abdominal Magnetic Resonance Imaging (Mosby)
12. Roger C. Sounders: Clinical Sonography: A Practical Guide (Little Brown & Company)
13. Pes Palmer: Manual of Diagnostic Ultrasound (WHO)
14. Sandra L Hagen Ansert: Text Book of Diagnostic Ultrasonography (Bi Publications).

DIAGNOSTIC IMAGING TECHNIQUES & MODALITIES

Practical/Clinical: 300 Hours

General Guidelines

When performing the imaging procedures, the candidate must demonstrate appropriate:

- Evaluation of requisition and/or medical record
- Preparation of examination room
- Identification of patient
- Patient assessment and education concerning the procedure
- Documentation of patient history including allergies
- Patient positioning
- Protocol selection
- Parameter selection
- Image display, filming, and archiving
- Documentation of procedure, treatment and patient data in appropriate record
- Patient discharge with post-procedure instructions
- Universal precautions
- Radiation protection
- Preparation and/or administration of contrast media
- And evaluate the resulting images for: Image quality (e.g., motion, artifacts, noise)
- Optimal demonstration of anatomic region (e.g., delayed imaging, reconstruction spacing, Algorithm, slice thickness)
- Exam completeness

Unit No.	Topics	Mode of Teaching
	COMPUTED TOMOGRAPHY PROTOCOLS	
1.	**Head** • Routine head • Sinuses • Facial / orbit • Temporal bones • Trauma head • Vascular head (CTA) • Cross sectional anatomy	
2.	**Neck** ? Soft tissue neck ? Larynx and vocal cords ? Vascular neck (CTA) Cross sectional anatomy	

3.	**Spine and Musculoskeletal** • Lumbar • Cervical • Thoracic • Spinal trauma • Upper extremity • Lower extremity • Pelvic girdle; hips • Musculoskeletal trauma • Cross sectional anatomy	Clinics
4.	**Chest** • Routine chest • HRCT • Vascular chest (e.g., PE) • Chest trauma • Airway (trachea, bronchus) • Heart (e.g., cardiac scoring, Angiography) • Cross sectional anatomy	
5.	**Abdomen** • Routine abdomen • Liver (multi-phase) • Kidneys (with contrast) • Pancreas • Adrenals • GI tract • Abdominal trauma • Vascular abdomen (CTA) • Cross sectional anatomy	
6.	**Pelvis** • Routine pelvis • Bladder • Pelvic trauma • Vascular pelvis (CTA) • Colorectal studies • Cross sectional anatomy	
7.	**Special Procedures** • Biopsies • Drainage / aspirations	
8.	**Image Display and Post Processing** • Geometric measurements (e.g., stent graft, distance) • ROI • Retrospective reconstruction	

ULTRASONOGRAPHY PROTOCOL		
1.	**Head & Neck** • Soft tissue neck • Larynx and vocal cords • Arteries and veins • Cross sectional anatomy	Clinics
2.	**Abdomen** • Routine abdomen • Liver • Kidneys • Pancreas • Adrenals • GI tract • Abdominal trauma • Arteries & Veins • Cross sectional anatomy	
3.	**Pelvis** • Routine pelvis • Bladder • Pelvic trauma • Colorectal studies • Cross sectional anatomy	
4.	**Upper limb & Lower limb** • All related arteries and veins	
5.	**Special Procedures** • Biopsies • Drainage / aspirations	
DIGITAL RADIOGRAPHY TECHNIQUES		
	The student should be aware of the advanced in radiology equipments, performing procedures, handling the computerized and digital equipment and quality control and quality check of the equipment in: • Computed radiography • Digital radiography • PACS • DSA • Mammography • Dental radiography • Macro radiography • Digital x ray techniques of whole body	Clinics
MAGNETIC RESONANCE IMAGING		

1.	**Head and Neck** • Routine brain • Internal auditory canal • Orbit • Pituitary • Vascular head • Cranial nerves • Posterior fossa • Head trauma • Sinuses • Soft tissue neck • Vascular neck	
2.	**Spine** • Thoracic • Lumbar • Cervical • Sacrum / coccyx • Spinal trauma • Bony pelvis	Clinics
3.	**Thorax** • Brachial plexus • Mediastinum • Cardiovascular • Breast • Aorta • Heart and great vessels	
4.	**Abdomen and Pelvis** • Liver / spleen / pancreas* • Kidneys • Adrenals • MRCP • Vascular • Male pelvis • Female pelvis	
5.	**Musculoskeletal System** • Upper limb • Lower limb	

Scheme of Examination

Practical:

There shall be a university practical examination in the subject of Diagnostic Imaging Techniques & Modalities for 100 marks.
The internal assessment is for 20 marks.

Pattern for Practical Examination

Sl. No.	Particulars	Marks
1	Practical Exercise	40
2	Viva-Voce	40
Total		**80**

RADIOGRAPHIC SPECIAL PROCEDURES AND PATIENT CARE

No. of Theory Classes: 100 Hours
No. of Practical Classes: 300 Hours

Unit No.	Topics	No. of Hours	Mode of teaching
1.	**Introduction to the subject** • Diagnostic procedures • Therapeutic procedures	1	Lecture Discussion Presentation
2.	**Contrast media** • Definition • Classification • Chemistry • Physiology • Toxicity • Treatment- emergency drugs • C M used in USG	5	Lecture Discussion Presentation
3.	**Intravenous Urogram (IVU/IVP)** • Anatomy of urinary system • Indications Contraindications & Risk factors • Contrast media, Preparation, procedure • Filming technique • IVU in children • Special views & modifications of Urogram • Nephrotomogram • Complications & after care	2	Lecture Discussion Presentation
4.	**Retrograde pyeloureterography** • Indications & contraindications • Procedure & filming • Complications & aftercare	1	Lecture Discussion Presentation
5.	**Micturating Cystourethrogram (MCU)** • Anatomy of lower urinary tract • Indications & contraindications • Preparation, Procedure & filming • Complications • Other techniques	1	Lecture Discussion Presentation

6.	**Ascending Cystourethrogram (ASU)** • Indications & contraindications • Preparation, technique, procedure • Filming • Complications & after care	1	Lecture Discussion Presentation

7.	**Myelogram** • Anatomy of spinal cord • Definition, indication & contraindication • Preparation requirements & contrast media • Lumbar, cisternal & lateral cervical puncture • CT myelogram	3	Lecture Discussion Presentation
8.	**Contrast media in GIT** • Introduction • Properties of an ideal barium preparation • Advantages of barium sulphate preparation • Manufacture • Characteristics influencing coating • Adverse effects • Other contrast media used • Contrast media used for CT in GIT	3	Lecture Discussion Presentation
9.	**Barium swallow** • Anatomy of upper GI tract • Indications & contraindications • Contrast • Procedure and techniques • Specific conditions • Complications	3	Lecture Discussion Presentation
10.	**Barium meal** • Anatomy of stomach • Indications & contraindications • Preparation • Contrast media • Standard views • Conventional single contrast study • Double contrast barium study • Biphasic study of upper GIT • Hypotonic duodenography • After care & complications	3	Lecture Discussion Presentation
11.	**BMFT** • Anatomy of GI tract • Indications & contraindication • Contrast medium • Patient preparation • Small bowel follow through • Dedicated small bowel follow through • Peroral pneumocolon • Retrograde small bowel examination • Advantages, disadvantages & complications	3	Lecture Discussion Presentation

12.	**Enteroclysis** • Anatomy of small bowel • Indication contraindication • Equipment, contrast medium • Preparation • Techniques • Single contrast study • Double contrast study • Air D C enteroclysis • Comparison • Advantages, disadvantages & after care	3	Lecture Discussion Presentation
13.	**Barium enema** Anatomy of large bowel • Definition, indication, contraindication • Contrast • Preparation and positioning • DCBE, SCBE • Special barium enema studies Aftercare & complications	3	Lecture Discussion Presentation
14.	**HSG** • Anatomy of female reproductive system • Definition, indication and contraindication • Equipments, procedures & techniques After care & complications Sonosalpingiography	2	Lecture Discussion Presentation
15.	**FTR** • Definition, indication and contraindication • Instrumentation • Timing of the study, patient preparation • Technique and filming Other methods Post procedure follow up and complications	2	Lecture Discussion Presentation
16.	**Sialography** • Anatomy of salivary glands • Definition, indication & contraindication • Equipments • Preparation of the patient • Procedure & filming	2	Lecture Discussion Presentation
17.	**Dacrocystography** • Anatomy of nasolacrimal duct • Definition, indications & contraindication • Materials and techniques • Complications & after care • Other techniques	2	Lecture Discussion Presentation

18.	**Catheters** • Classification • Catheters used for different studies • Sterilization of catheters • Balloon angioplasty catheters	3	Lecture Discussion Presentation
19.	**Angiography (cerebral, visceral, peripheral)** • Anatomy of blood vessels • Definition indication & contraindication • Patient preparation and precautions • Local anaesthesia • Direct needle puncture • Catheter angiography • Percutaneous transluminal angioplasty	4	Lecture Discussion Presentation
20.	**T-tube / PTC / direct portal Venography overview**	3	Lecture Discussion Presentation
21.	**Biliary system procedures (PTBD/ERCP/PTC)**	2	Lecture Discussion Presentation
22.	**Bronchography and phlebography overview**	2	Lecture Discussion Presentation
23.	**Introduction to Patient Care** • Responsibilities of the Healthcare facility • Responsibilities of the Imaging Technologist	2	Lecture Discussion Presentation
24.	**Nursing Procedure in Radiology** • General abdominal preparation • Clothing of the patient • Giving an enema Handling the emergencies in Radiology First aid in the X-Ray department.	2	Lecture Discussion Presentation
25.	**Patient care during Investigation** • G.I. Tract • Biliary tract • Respiratory tract • Gynecology • Cardiovascular • Lymphatic system • C.N.S etc	2	Lecture Discussion Presentation
26.	**Infection Control** • Isolation technique • Infection sources • Transmission modes • Procedures • Psychological considerations • Sterilization & sterile techniques.	2	Lecture Discussion Presentation

27.	**Patient Education** • Communication • Patient communication problems • Explanation of examinations • Radiation Safety / Protection • Interacting with terminally ill patient • Informed Consent	2	Lecture Discussion Presentation

Scheme of Examination:

Theory:

There shall be one theory paper of three hours duration carrying 100 marks.
The marks for internal assessment is 20 marks.
Distribution of type of questions and marks shall be as given under:

SUBJECTS HAVING MAXIMUM MARKS= 100		
Type of Questions	**No. of Questions**	**Marks for Each Questions**
Long Essay	2	10
Short Essay	10	05
Short Answer	10	03

1. Long essay- 2 Questions (Second question choice) 2x10= 20 marks
2. Short essay- 10 Questions (Questions no 5 &10 choice) 10x5= 50 marks
3. Short answer- 10 Questions (No choice) 10x3= 30 marks

Total= 100

Reference Books:

1. Bhushan and Lakkhar Radiological procedures
2. Chapman A guide to radiological procedures
3. Care of Patients in Diagnostic Radiology- Gunn
4. Patient care in radiography- Mosby Elsevier publication

RADIOGRAPHIC POSITIONING AND SPECIAL PROCEDURES

Clinical/ Practical - 600Hours

Mode of Teaching: Clinics

General anatomy, terminology, and positioning principles

- General, systemic and skeletal anatomy
- Positioning terminology
- Positioning principle

The student should be made familiar with radiographic appearance both normal subject and of common abnormal conditions where elementary knowledge of the pathology involved will

ensure the application of the appropriate radiographic technique, which may be necessary for various disabilities or types of subject.

For each area studied, the topics will be presented under the following headings:

a. Anatomy (review)
b. Clinical indications.
c. Preparation of patient
d. Accessory equipment
e. Routine views
f. Supplementary views: modifications in cases of trauma
g. Radiation protection
h. Care of patient

For each view studied will be presented as follows.

a. Positioning of patient.
b. Immobilization
c. Identification
d. Centering point
e. Direction of central X-ray relative to the film
f. Parts demonstrated
g. Exposure factor - kVp, mAs, FFD grid/ non-grid screen
h. Cassette size

Technical skill and patient care may be emphasized to the following categories:

b. Children and neonates
c. Seriously ill or injured patients
d. Elder patients
e. Deaf and blind patients
f. Language difficulties.
g. Unconscious patients or Anaesthetized patients.

Objectives:

At the end of the course, the student should be able to understand the following:

1. Knowledge about the radiographic positioning and related anatomy.
2. Technical factors used while taking X-rays.
3. Patient care given during the positioning.
4. Patient care for pediatrics, geriatrics, and during bedside radiography.

General anatomy, terminology, and positioning principles

- General, systemic and skeletal anatomy
- Positioning terminology
- Positioning principle

Unit	Topics	Mode of Teaching
1.	**RADIOGRAPHIC POSITIONING:** **Routine and Special projections including the radiological anatomy and Imaging characteristics for the following:** 1. Chest 2. Shoulder 3. Humerus 4. Elbow 5. Forearm 6. Wrist 7. Hand 8. Fingers 9. Femur 10. Knee 11. Leg 12. Ankle 13. Foot 14. Pelvis 15. Neck 16. Chest 17. Abdomen 18. KUB 19. Pelvis 20. Hip 21. Spine **RADIOLOGICAL SPECIAL PROCEDURES** a. All radiographic procedures including: b. IVU c. MCU d. Retrograde pyelourethrogram e. Myelogram f. Ba studies g. HSG/ FTR h. Sialography i. T- tube cholangiography j. Percutaneous transhepatic cholangiography k.Bronchography l. Angiography m. Phlebography n. Dacrocystography	Clinics

Scheme of Examination:

Practical

There shall be a university practical examination in the subject of Radiographic Positioning and Special Procedures for 100 marks.

The internal assessment is for 20 marks.

Pattern for Practical Examination:

Sl. No.	Particulars	Marks
1	Practical Exercise	40
2	Viva-Voce	40
Total		**80**

Reference Books:

1. Bhushan and Lakkhar Radiological procedures
2. Chapman A guide to radiological procedures
3. Care of Patients in Diagnostic Radiology- Gunn
4. Patient care in radiography- Mosby Elsevier publication
5. Philip W. Ballinger: Atlas of Radiographic Positioning and Radiological Procedures (Mosby)
6. Ra Swallow, E Naylor: Clarks Positioning in Radiography
7. Ross and Gailway: A Handbook of Radiography (Lewis)
8. Glenda J.Bryan: Diagnostic Radiography (Mosby)
9. Meril's Atlas of radiographic positioning and Radiological procedure

IV Year BSc. Medical Imaging Technology

INTERNSHIP

A student after having successfully completed the final year university examination is qualified to commence the Compulsory Rotatory Internship. The completion of Internship is mandatory to enable a student to obtain the degree of Bachelor of Medical Imaging Technology.

Aims:

The internship program is designed to facilitate the transition from student hood to becoming a competent professional. It is meant to instill in the students clinical practice skills, which would encompass the following qualities:

- Sense of timing.
- Work behaviors, roles and routines
- Communication and interaction skills with patients, colleagues, supervisors & other professionals of multidisciplinary team.
- Ability to take certain independent decisions exercising their clinical judgment.
- Ability to deal with a critical situation using analytical skills.
- Successful completion of the internship program will facilitate the students to become competent independent Medical Imaging Technologists.

Procedure:

- After the 3rd year BSc. MIT University Examination results are declared, the candidate has to obtain no-dues clearance from various departments and sections as prescribed by the University.
- On submission of the no dues clearance to the college office, a **No Dues** slip will be issued to the student.
- The student should submit the no due slip to the Head of Medical Imaging Technology. • Faculty in charge will give the Clinical posting schedule & Guidelines for internship program.

Duration and Description:

The internship program is of **one-year** duration.
A student doing internship has to practice under supervision of experienced staff in all the modalities of radio diagnosis and imaging.
All the postings are **compulsory.**

Ordinances:

- The intern will be eligible for 2 days casual leave in each month and he/she can carry over the leave to next months, but he/she cannot avail the next month leave in advance.
- The interns should conduct themselves in a manner befitting the profession.

- The intern should dress appropriately in the clinical areas (Men in trousers and shirt, women in salwar suits).
- It is mandatory for the intern to wear the white apron with nametag when in the clinical area.
- The intern will get a monthly stipend.
- The intern will be allowed to attend the National Conference, leave will be granted only for the days of conference and travel days. • Any other leave declared by the University for the students will not apply to the interns.

SUGGESTED BOOKS

SI. No	NAME OF THE BOOK	AUTHOR
	ANATOMY	
1	Manipal Manual of Anatomy	Dr. Sampath Madhyastha
2	Human Anatomy	B. D. Chaurasia
	PHYSIOLOGY	
1	Manipal Manual of Physiology	C.N.Chandrasheka
2	Text Book of Physiology	Prof. A. K. JAIN
3	Basics of Medical Physiology- Third edition	D.Venkatesh & H.H. Sudhakar
	BIOCHEMISTRY	
1	Text Book of Biochemistry	V. Sathyanarayanan
2	Text book of Biochemistry with Clinical Correlation	Thomas M Devlin
	PATHOLOGY	
1	Harsh MohansText Book of Pathology	Harsh Mohan
2	Robbins &Cortran Pathologic Basis of Diseases	Mitchell, Kumar, Abbas, Fausto
3	General & Systemic Pathology	J. C. E. Underwood
	MICROBIOLOGY	
1	Text Book of Microbiology	Ananthanarayan & R. Jayaram
2	General Microbiology	Roger Y Stanier, John L Ingrahan
	RADIATION PHYSICS	
1	Christensen"s Physics of Diagnostic Radiology	Thomas Curry, James E Dowdey , Robert C Murry
2	Essential Physics of Medical Imaging	Jerrold T Bushberg, J Antony Seibert, Edvin M Leidholdt
3	Fundamental of X-Ray and Radiation Physics	Joseph Selman

RADIATION PROTECTION		
1.	Radiologic Science for Technologists	Stewart C. Bhushong
2.	Radiation Protection in Medical Radiography	E. Russel Ritenour
3.	ICRP Manual	-
IMAGIMG PHYSICS & DARKROOM TECHNIQUES		
1	Chesney"s Radiographic Imaging	John Ball & Tony Price
2	Fundamental of X- Ray and Radiation Physics	Joseph Selmen
3.	Christensen"s Physics of Diagnostic Radiology	Thomascurry, James E Dowdey, Robert C Murry
COMPUTED TOMOGRAPHY		
1.	CT Seeram	Dr Seeram Eudid
ULTRASOUND		
1.	Diagnostic U S Principle And Instruments	Dr. Frederick w kremkau
RADIOGRAPHIC POSITIONING AND TECHNIQUES		
1	Merrills Atlas of Radiographic Positioning &Radiological Procedure	Philip W Ballinger & Ergene D Frank
2	Text Book of Radiographic Positioning & Related Anatomy	Kenneth L Bontrager
3	Clarks Positioning in Radiography	R. A. Swallow, E Naylor
RADIOGRAPHIC SPECIAL PROCEDURES AND PATIENT CARE		
1	Radiological Procedures	Dr. Bhushan N
2	Patient Care in Radiography	Ruth Ann Ehrlich Ellen Double McCloskey Joan A. Daly
MAGNETIC RESONANCE IMAGING		
1	MRI In Practice	Catherine Wesstbrook& CaralynKaut
2	Hand Book of MRI Techniques	Catherine Westbrook
DIGITAL RADIOLOGY		
1	PACS Basic Principles & Applications	H. K. Huang
2	Diagnostic U.S Principles And Instruments	Frederick W Kremkau
NUCLEAR MEDICINE		
1	Physics in Nuclear medicine	Soroenson
2	Physics of Nuclear medicine	Powsner
COMMUNICATION SKILLS		
1	Crystal clear	Kris Cole/EW
2	English conversation Practice	Grant Taylor/TMH
3	The most common mistakes in English	Thomas Elliot Berry/TMH