



SHRI
DHARMASTHALA
MANJUNATHESHWARA
UNIVERSITY

ORDINANCE GOVERNING
B.SC. IN ALLIED HEALTH SCIENCES
**BACHELOR OF SCIENCE IN
MEDICAL IMAGING TECHNOLOGY**
CURRICULUM 2020-21

SHRI DHARMASTHALA MANJUNATHESHWARA UNIVERSITY

(A State Private University established under the Shri Dharmasthala Manjunatheshwara University
Act No 19 of 2018 of Government of Karnataka and Notification No. ED 261 URC 2018 dated 19th December 2018)

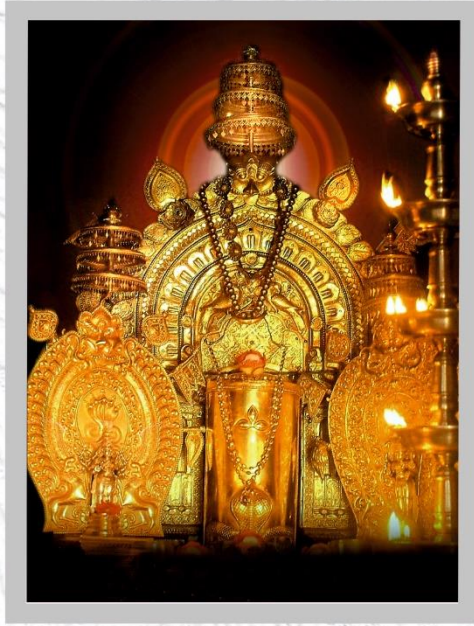
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|| Om Shri Manjunathaya Namaha ||



Shree Kshethra Dharmasthala

Edition Year : 2020-21

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THE LOGO

Poojya Dr D. Veerendra Heggade, Hon'ble Chancellor of the University, while searching for an appropriate Logo for the University, saw a photograph picked from Temple Architecture showing Wings of a Bird, sculpted in Indian style and wanted it to be incorporated in the logo for the University, as the Wings symbolize 'Spreading of Knowledge beyond Boundaries'. Further it was felt that the Central theme of the logo should be 'Rudra' (The Linga) with wings on each side. In this way, the logo of the University was conceptualized.

Hence:

1. The central part represents **Rudra** who Demolishes Darkness.
2. The Three **horizontal lines on The Linga** stand for Samyak Darshan (Right Belief), Samyak Gyan (Right Knowledge) and Samyak Charitra (Right Conduct).
3. The **Wings** symbolize spreading of Knowledge across the boundaries.
4. Base line "**Truth Liberates**" highlights the Purpose of Education: to liberate oneself unconditionally. It shows that it is not discipline, nor knowledge nor the efforts to freedom that liberate but Truth is what liberates you from all your conditioning and ignorance.

The overall significance of Shri Dharmasthala Manjunatheshwara University's Logo is:

Darkness of ignorance is destroyed by the flow of knowledge to bring Liberty to everyone, by realizing the truth. And, it should spread globally without the boundaries as hindrance.



SHRI
DHARMASTHALA
MANJUNATHESHWARA
UNIVERSITY

VISION

Shri Dharmasthala Manjunatheshwara University will set the highest standards of teaching and learning by awakening the intelligence of the students and nurturing the creativity hidden in them by creating an environment where the ancient wisdom blends with modern science, to transform them into whole human beings to face the challenges.

MISSION

- ▶ To ensure that the journey of education is inspiring, pleasant and enjoyable.
- ▶ Attract the best of teachers and students.
- ▶ Achieve high principles of trust, love and spirituality in the students.
- ▶ Create a collaborative, diverse and exclusive community.
- ▶ Transform the student of today to be a leader of tomorrow and a better human being.
- ▶ Produce passionate teachers.
- ▶ Evolve innovative teaching techniques.
- ▶ Create a peaceful environment.
- ▶ Prepare the student to face the social challenges.
- ▶ Create a University of which the Nation is proud of.
- ▶ Be an effective partner in Nation Building.
- ▶ Create an Eco-friendly University.
- ▶ Create a University based on the principles of beauty, love and justice.

||Om Shanti! Om Shanti! Om Shanti||



SHRI
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UNIVERSITY

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SDMU/ACD/DEN/CRM/369A/2019

Date: 28-08-2019

NOTIFICATION

Ordinance governing Curricula of Medical Allied Sciences - 2019

- Ref:
1. Minutes of the 1st Meeting of Academic Council held on 20th March 2019 (Letter No: SDMU/AC/M-01/093/2019; Dated:21-03-2019)
 2. Minutes of the 1st Meeting of Joint Faculties held on 19th March 2019 (Letter No: SDMU/JF/85/2019; Dated:21-03-2019)
 3. Minutes of the 1st Meeting of Board of Studies (Allied Health Sciences) held on 19th March 2019 (Letter dated:20-03-2019)

In exercise of the powers conferred under Statutes 1.4(Powers and functions - Para ix & x), 1.5b(Powers and functions - Para b & c) & 1.8(Powers and functions - Para i) of Shri Dharmasthala Manjunatheshwara University, the Academic Council is pleased to approve and notify the Ordinance governing Regulations and Curricula of the below listed Medical Allied Sciences as shown in the annexure appended herewith.

1	BSc Medical lab Technology
2	BSc Medical Imaging Technology
3	BSc in Renal Dialysis Technology
4	BSc Optometry

The ordinance shall be effective for the students joining the courses during the academic year 2019-20 and onwards.


REGISTRAR
REGISTRAR,
Shri Dharmasthala Manjunatheshwara
University, Dharwad

To: The Principal, SDM College of Medical Sciences & Hospital.

Copy for kind information to:

1. Hon'ble Vice Chancellor - Shri Dharmasthala Manjunatheshwara University.
2. Pro Vice Chancellor (Academics) - Shri Dharmasthala Manjunatheshwara University.
3. Controller of Examinations - Shri Dharmasthala Manjunatheshwara University.

B. Sc. Medical Imaging Technology

1. Title of the Courses offered in Allied Health Sciences:

Bachelor of Science in Medical Imaging Technology [B.Sc. in Medical Imaging Technology]

2. Eligibility for admission:

A candidate seeking admission to the Bachelor of Science Degree Courses in the Allied Health Sciences course, shall have studied English as one of the principal subject during the tenure of the course.

a. Two year Pre-University examination or equivalent as recognized by SDM University with, Physics, Chemistry and Biology as principle subjects of study.

OR

b. Any equivalent examination recognized by the SDM University for the above purpose with Physics, Chemistry and Biology as principal subjects of study.

OR

c. Candidates with two years diploma from a recognized Government Board in a subject for which the candidate desires to enroll, in the respective Allied Health Sciences course mentioned shall have passed plus 12 [10+2] with Physics, Chemistry and Biology, as principal subjects.

d. Lateral entry to second year for allied health science courses for candidates who have passed diploma program from the Government Boards and recognized by SDM University, fulfilling the conditions specified above.

Note:

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

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

3. Intake: 10 seats

4. Duration of the course:

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

5. Medium of instruction:

The medium of instruction and examination shall be in English.

6. Attendance

Every candidate should have attended at least 80% and 35% IA marks 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.

7. Internal Assessment (IA):

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 SDM 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 college 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.

Please refer each subject Internal Assessment format

8. Subject and hours of teaching for Theory and Practical

PART-I

- i. Anatomy and related pathology of human body Part-I
- ii. Radiological science for technologist and darkroom Techniques
- iii. Patient care in Radiography
- iv. Basic Radiographic techniques

PART-II

- i. Physiology and related pathology of human body Part-II
- ii. Equipment for Radio diagnosis Part-I
- iii. Physics for medical imaging
- iv. Basic radiographic techniques II and special procedures

PART-III

- i. Special procedure in Radio diagnosis, Planning & QA in Radio diagnosis
- ii. Equipment for Radio diagnosis including newer developments
- iii. Modern Imaging Technology
- iv. Radiation physics and radiation protection

9. Hours of instruction of theory and clinical training per week
 10 hours of teaching per week [Part-I]
 30 hours of clinical training per week [Part-I]
 10 hours of teaching per week [Part-II]
 30 hours of clinical training per week [Part-II]
 10 hours of teaching per week [Part-III]
 30 hours of clinical training per week [Part-III]
10. Total hours teaching (theory only) for 3 years

Subject	No. of hrs.
Anatomy and physiology and General/Systemic pathology	160 hrs
Radiological science for technologist & Dark room technique	100 hrs
Patient care in Radiography	100 hrs
Film discussions , seminars , journal clubs	120 hrs
Radiographic techniques including special procedures	120 hrs
Equipment for Radio diagnosis including newer development and quality assurance	120 hrs
Physics for medical imaging and radiation physics including radiation protection	160 hrs
Planning an Quality control in Radio diagnosis	120 hrs
CT-Scan , MRI , PET-Scan ,Ultra sonography , Nuclear Imaging , Mammography , Special procedure , (Modern Imaging Technology)	160 hrs
Total	1160 hrs

11. Total hrs of practical training for 3 years

Year	Radio-diagnosis
Part - I	1200 Hrs
Part - II	1200 Hrs
Part - III	1200 Hrs

12. Clinical training posting in Radio diagnosis on rotational basis

Part - I	
Patient Registration	2 weeks
Dark Room Practice	5 weeks
Extremities radiography	6 weeks
Chest radiography including ribs	7 weeks
Abdomen radiography	6 weeks
Patient care	6 weeks
Vertebral – column radiography including Pelvic girdle	6 weeks
Total	38 weeks
Part - II	
Barium studies (GI tract)	6 weeks
IVU	6 weeks
Special procedures – HSG , Myelography, Dacrocystography, Arthrography and Cavitography etc.	6 weeks
Operation theatre Technique	4 weeks
Skull including PNS and facial	6 weeks
Ward radiography/including trauma	6 weeks
MCU, RGU, and Cystography etc	6 weeks
Dental radiography	2 weeks
Total	40 weeks
PART- III	
Mammography	6 weeks
Interventional procedures ; vascular and nonvascular including ERCP, PTC, PTBD, and PCN etc	6 weeks
CT	6 weeks
US/Color Doppler	6 weeks
MRI	6 weeks
DSA	2 weeks
Quality assurance and radiation protection	6 weeks
Hospital practice and care of patient	2 weeks
Total	40 weeks

13. Schedule of Examination:

The university shall conduct one examination annually & two internal assessments 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.

14. Scheme of Examination

Final examination is conducted at the end of each year in the following subjects For the Part I, Part II, Part III.

PART - I
Theory Papers

- | | |
|---|-----------|
| 1) Anatomy, related pathology of Human body | 100 marks |
| 2) Radiological science for technologist
and darkroom techniques | 100 marks |
| 3) Patient care in Radiography | 100 marks |
| 4) Basic Radiographic techniques | 100 marks |

Practical's: 100 marks

Internal assessment in the all above subjects including practical: 30 marks

(Marks distribution of all subjects 100 = Theory 70 + Internals 30)

Board of examiners comprises of one external and one internal examiner.

PART - II
Theory paper

- | | |
|---|-----------|
| 1) Physiology and related pathology of Human body | 100 marks |
| 2) Equipment for radio diagnosis Part-I | 100 marks |
| 3) Physics for medical imaging | 100 marks |
| 4) Basic radiographic techniques II and special procedure | 100 marks |

Practical's: 100 marks

Internal assessment in the entire above subjects (30 marks in each subject including practical)

Board of examiners comprises of one external and one internal examiner.

PART – III
Theory paper

- | | |
|--|-----------|
| 1. Special procedure in Radiographic, Planning & QA in Radio-diagnosis | 100 marks |
| 2. Equipment for Radio-diagnosis including newer developments | 100 marks |
| 3. Modern Imaging Technology | 100 marks |
| 4. Radiation physics and Radiation protection | 100 marks |
| | |
| Practical 1 (Special Procedures in Radiography): | 100 marks |
| Practical 2 (Radiation protection & Modern Imaging): | 100 marks |

Internal assessment in the entire above subjects (30 marks in each subject including practical)

Board of examiners comprises of one external and one internal examiner.

Distribution of Type of Questions and Marks for Various Subjects

	First Year	Second Year	Third Year
Theory	$70 \times 4 = 280$ Marks	$70 \times 4 = 280$ Marks	$70 \times 4 = 280$ Marks
Practical and Viva Voce	$70 \times 1 = 70$ Marks	$70 \times 1 = 70$ Marks	$70 \times 2 = 140$ Marks
Internal Assessment	$30 \times 5 = 150$ Marks	$30 \times 5 = 150$ Marks	$30 \times 6 = 180$ Marks
Total	500 Marks	500 Marks	600 Marks

Theory 70 Marks division as follows

1. 10 Marks Question – 2
2. 05 Marks Question – 6
3. 02 Marks Question – 10

3. Pass criteria

- a) Has passed all the three examinations.
- b) Has satisfactory completed the full period of period of 3 years.
- c) His /her work and conduct during the period of training has been

satisfactory.

A candidate is declared to have passed the Examination in a subject if he/she secures 40% of the marks in theory and 40% in practical separately. For a pass in theory & Practical, a candidate has to secure a minimum of 50% marks in the University conducted written examination in aggregate including internal assessment and Viva-Voce.

4. Carryover benefit

Students who appear for annual examination and failed will be promoted to the next year, irrespective of results, up to supplementary exam results. The candidate should clear all the remaining failed subjects of the previous year in forth coming supplementary exam. If candidate is failing to clear all the failed subjects of previous year in the supplementary exam, He/she will not be allowed for 2nd year annual examination. Supplementary exam for failed candidates shall be conducted within 60 days after the announcement of annual examination results. The candidates who all are unable to pass in all subjects of the previous year, He/ She will not be promoted to the next year.

5. **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 award of degree.

TRAINING

The training includes both lectures and practical training. For the practical training, the students are posted in various sections, rooms and labs in Radiodiagnosis department and other departments of the hospital and they engage themselves in the day-to-day work together with the employed technicians, under the control of tutor technicians and supervisors. For this purpose, the students spend three years and are posted for specific period in all the sub-specialties, operation theatres and other areas in each department.

**FIRST YEAR
BACHALORE OF SCIENCE
IN
MEDICAL IMAGING TECHNOLOGY
(1ST B. Sc. MIT)**

OUTLINES OF SYLLABUS FOR FIRST YEAR

PAPER-I
ANATOMY AND GENERAL PATHOLOGY

ANATOMY – Theory Teaching Hours- 70 hours, Practical- 30 hours Total- 100 hours

SN	Topic	Theory	Practical
1	<p>Introduction to the body as a whole Anatomical terms of position, planes and movements The cells, tissues of the body The cell: Structure, multiplication Practicals: Demonstration</p>	3	1
2	<p>Tissues :Types structure, characteristics, functions Epithelium: Squamous, Cuboidal, columnar, ciliated Compound: Stratified, transitional Connective tissue : Areolar, adipose, fibrous, elastic, cartilage, and bone Muscles: Striated (voluntary), smooth (involuntary), Cardiac Nervous tissue : classification, neurons, neuroglial cells, functions Membranes : mucous, serous, and synovial Practicals: Demonstration of histology slides</p>	5	2
3	<p>Osteology (including whole skeleton, bones and joints) Development of bone (Osteogenesis): Cells involved Types and functions of bone, types of joints and various movements</p> <p>Axial Skeleton Skull : Cranium, face, air sinuses Vertebral column: Regions, movements and vertebrae characteristics, Sternum, Ribs Appendicular skeleton: Bones involved-shoulder girdle and upper limb, Pelvic girdle and lower limb Practicals-Demonstration of skeleton , individual bones identification, Normal x rays of bones and joints</p>	8	3

4	<p>Respiratory system- position, structure and functions</p> <p>Nose and nasal cavities- parts of nose, nasal septum, lateral wall of nasal cavity, blood supply and nerve supply, functions, applied anatomy</p> <p>Nasopharynx, larynx - Structure in detail, blood supply, nerve supply, functions, applied anatomy</p> <p>Trachea- structure, functions, histology and applied anatomy</p> <p>Lungs- Right & Left Lung Gross anatomy, borders and surfaces, lobes, impressions, blood supply, nerve supply, histology, common diseases, applied anatomy</p> <p>Bronchi, Bronchioles, alveoli, broncho pulmonary segments applied anatomy</p> <p>Pleura with applied anatomy</p> <p>Practicals: Demonstration of respiratory system parts, demonstration of normal radiographs of paranasal air sinuses, larynx, and chest x rays, histology of Trachea & lung slides</p>	6	2
5	<p>Cardiovascular system (Heart and blood vessels)</p> <p>Blood vessels- arteries, veins, capillaries, sinusoids, structure and functions</p> <p>Heart -Position, structure and functions, common diseases of heart</p> <p>Circulation of blood -Pulmonary, systemic, portal, main blood vessels, their origins and Diseases of blood vessels and conditions of the system</p> <p>Practicals- Demonstration of chambers of heart, valves, coronary arteries, coronary sinus, great vessels, major blood vessels of body like aorta, SVC, IVC</p> <p>Chest x rays for cardiac shadow, angiograms</p>	6	3

6	<p>Lymphatic system The parts of the lymphatic system Lymph channels: capillaries, vessels, ducts structure, and functions Lymph nodes: position, structure and functions Lymphatic tissues tonsils, adenoids, intestinal nodules Spleen: position, structure and functions Diseases and conditions of the system Practicals- Demonstration of groups of lymph nodes, thoracic duct, Spleen, Palatine tonsil, Thymus , Lymphangiograms , Histology slides of lymphoid organs</p>	4	2
7	<p>Digestive system Elementary tract structure: Mouth –position, structure and functions Pharynx- position, structure and functions Salivary glands - position, structure and functions. Esophagus- position, structure and functions Stomach - position, structure and functions Liver - position, structure and functions. Gallbladder - position, structure and functions Pancreas - position, structure and functions Small intestine - position, structure and functions. Large intestine – position, structure and functions Diseases and conditions of the digestive system Practicals- Demonstration of mouth, Tongue, Teeth, salivary glands, pharynx, oesophagus, stomach, small and large intestine, liver, gall bladder and pancreas Plain x rays of abdomen, erect, and supine, barium swallow, meal, follow through, barium enema x ray films, Histology of Liver</p>	8	4

8	<p>Urinary system (Excretory system) Parts of urinary system. Kidneys - Position, structure and functions Ureters- Position, structure and functions Urinary bladder - Position, structure and functions Urethra - Position, structure and functions Diseases and conditions of the system Practicals: Demonstration of kidneys, ureters, urinary bladder and urethra, KUB X-ray, IVP, Micturating cystourethrogram, , Cystoscopy Histology of Kidney</p>	6	3
9	<p>The reproductive system Female reproductive system External genitalia: position, structures and functions Perineum Internal organs: position, structure and functions of Vagina, Uterus, Fallopian tubes, Ovaries Menstrual cycle: stages, hormone control, ovulation Breasts (mammary glands) - position, structure and functions Changes in: puberty, in pregnancy, during lactation</p> <p>Male reproductive system Scrotum, testis, epididymis: position, structure and functions, spermatogenesis Spermatic cords, seminal vesicles, ejaculatory ducts: position, structure and functions Prostate glands - position, structure and functions Urethra and penis - position, structure and functions Functions of male reproductive system. Puberty Diseases of female and male reproductive systems</p>	8	3

	Practicals: Demonstration of male and female reproductive organs, Histology of Ovary & Testis, Hysterosalpingogram.		
10	Endocrine system Endocrine glands: Pituitary and hypothalamus: position, structure and functions Thyroid gland: position, structure and functions Adrenal (Supra renal gland): position, structure and functions Parathyroid glands: position, structure and functions Pancreas: position, structure and functions Pineal gland Common terms and diseases related to the endocrine system Practicals: Demonstration of endocrine organs, histology of Pituitary, Thyroid, Parathyroid, Suprarenal, Pancreas.	4	2
11	Organs of sense Hearing and the ear: external, middle and inner ear- position, structure, functions and diseases of ear. Sight and the eye: position, structure and functions Sclera, cornea, choroids, ciliary body, iris, lens, retina, optic nerves Diseases of the eye Sense of the smell: olfactory nerves- origins, distribution. Sense of taste: Organs, Tongue, Papillae, Taste buds, Common diseases Practicals: Demonstration of sensory organs	4	2
12	Nervous system Neurons: position, structure and functions Central nervous system: neurons, neuroglia, meninges Ventricles of the brain, C.S.F. Brain: cerebrum, cerebellum, brain stem,	6	2

	<p>thalamus, hypothalamus, Internal capsule, basal ganglia Spinal cord: structure, functions Peripheral nervous system. Spinal and cranial nerves: origin distribution & functions Autonomic nervous system: origin, distribution, functions Sympathetic and Para sympathetic: origin, distribution, functions Common diseases of the system Practicals: Demonstration of all parts of Brain, Spinal cord, Demonstration of cranial nerves, spinal nerves, nerve plexuses</p>		
13	<p>Skin Structure of the skin: Epidermis, dermis Appendages of skin, histology of skin Functions of the skin Diseases of the skin Practicals: Histology of Skin</p>	2	1
	Total Hours	70	30

TEXT BOOKS RECOMMENDED (LATEST EDITIONS)

1. Human Anatomy by B. D. Chaurasia, 8th edition Vol-1, 2, 3, 4
2. B. D. Chaurasia's Hand book of General Anatomy, 6th edition
3. Text book of Anatomy & Physiology for nurses – P. R. Asha Lata & G Deepa, 3rd edition
4. Inderbir Singh's Text book of Human Histology with colour atlas and Practical Guide, 2016
5. Principles and Techniques in Histology Microscopy and Photomicrography 2nd edition 2018 by D R Singh

General Pathology:

1. General Pathology Adaptations, Cell Injury and Repair: Hyperplasia, atrophy, metaplasia, necrosis and apoptosis - Differences between apoptosis and necrosis.
2. Acute and Chronic inflammation: Five cardinal signs of inflammation- Outcomes of acute inflammation- Chronic Inflammation-Granulomatous Inflammation-Acute phase proteins
3. Tissue repair, regeneration and hemodynamic disorders: Cutaneous wound healing-
4. Pathologic aspects of repair-Hyperaemia and congestion-Thrombosis and Virchow triad- Embolism-Infarction-Shock; Bronchial asthma, COPD – Tumors Diseases of immune system : Hypersensitivity reaction-Type I, II, III, and IV hypersensitivity reactions
5. Neoplasia: Definition of neoplasia. Differences between benign and malignant tumors ; Metastasis ; Carcinogenesis – Causes ; Carcinoma of oral cavity – Causes; Etiology of Carcinoma cervix – type of virus implicated, high risk sero-types, Screening investigations; Breast carcinoma – Risk factors

SCHEME OF EXAMINATION:

Marks distribution: Anatomy 50+ Pathology 20= 70 Marks Theory exam

Paper	Subjects	Theory		*Practical/Viva		Total
		UE	IA	UE	IA	
1	Anatomy	50	10	-	10	70
2.	Related Pathology	20	10		00	30

*There shall be NO University practical examination in Anatomy

EXAMINATION PATTERN

PATTERN OF THEORY QUESTION PAPER

Anatomy

LONG ESSAYS (ANSWER ANY 1 OUT OF 2) 1X10 = 10 marks

SHORT ESSAYS (ANSWER ANY 4 OUT OF 6) 4X5 = 20 marks

SHORT ANSWERS (ANSWER ALL) 10X2 = 20 marks

Pathology

SHORT ESSAYS (ANSWER ANY 2 OUT OF 3) 2X5 = 10 marks
SHORT ANSWERS (ANSWER ALL) 5X2 = 10 marks

TOTAL

70 marks

Examiner: One internal and external examiner for university examinations

PAPER-II RADIOLOGICAL SCIENCE FOR TECHNOLOGIST

The Photographic process, introduction, visible light, images, produced by radiation, light sensitive photographic materials

- i) Photographic emulsions, The photographic latent image Positive process.
- ii) Film materials in X-ray film, History, structure of an X-ray film single sided films, types of films.
- iii) Spectral sensitivity of film material, graininess of film material speed and contrast of photographic materials
- iv) Sensitometry: Photography density, characteristics curves features of characteristic curve.
- v) Variation in the characteristic curve with the development Comparison of emulsions by their characteristic curves. Information from the characteristic curve.
- vi) The storage of film materials and radiograph: Storage of Unprocessed film, storage of radiographs.
- vii) Intensifying screens and cassettes, Luminescence: fluorescence and phosphorescence, Construction of an intensifying screen.
- viii) The fluorescent materials. Types of intensifying screens, Intensification factor. The influence of KV, scattered radiation, Detail, sharpness and speed, size of the crystals, reciprocity failure.
- ix) Cassette design, care of cassettes, mounting of intensifying screens.
- x) Care of intensifying screens, tests to check screen film contact and light leakage.
- xi) Film processing I Development the nature of development. Manual, automatic, The pH scale.
- xii) The constitution of developing solutions and properties of developing chemicals.
- xiii) The development time, factors in the use of a developer. Developers in processing systems.
- xiv) Film processing: fixing and role of a fixing solution. Constitution of the fixing solutions and properties of the constituent.

- xv) Fixers used in automatic processors. Factors affecting the use of the fixer.
- xvi) Regeneration of fixing solution Silver recovery and its various methods.
- xvii) Rinsing, washing and drying objections of rinsing and washing methods employed.
- xviii) Methods of drying films.
- xix) Preparation of solutions and making stock solution.
- xx) Processing equipment Materials for processing equipment, processors for manual operation, hangers, control of chemical temperature by heating and thermostat, immersion heaters as well as cooling methods.
- xxi) Maintenance of automatic processors and common faults.
- xxii) Dark Room: Layout and planning, Dark room construction nature of floor, walls, ceiling and radiation protection.
- xxiii) Type of entry, door design, Dark room illumination.
- xxiv) Dark room equipment and its layout, Location of pass through boxes or cassette hatches.
- xxv) Systems for daylight film handling: daylight systems using cassettes and without cassettes.
- xxvi) The radiographic image: Components in image quality- density contrast and details.
- xxvii) Unsharpness in the radiographic image, various factors contributing towards unsharpness.
- xxviii) The presentation of the Radiograph, Identifications markers and orientation Documentary preparation.
- xxix) Viewing accessories: Viewing boxes, magnifiers, viewing conditions.
- xxx) Light, images and their recording, The formation of light images, image formation by mirror, by a lens and aberrations of lenses.
- xxxi) Fluorography: An optical system for image intensifiers fluorography.
- xxxii) Cameras for fluorography sensitometer response of fluorography film.
- xxxiii) Processing equipment and procedures, graininess in fluoro-grams.
- xxxiv) Some special imaging process, Xero- radiography its meaning technique and application
- xxxv) Copying radiograph its technique and application.
- xxxvi) Subtraction its techniques as applied to radiography as well as its applications.
- xxxvii) Common film faults due to manufacturing as well as due to chemical processing.
- xxxviii) Management of the quality of the Radiographic image.
- xxxix) Practical's: (i) test to check x-ray films and screen contact in the cassette (ii) test to check light leakage in the cassette (iii) to prepare a characteristic curve of a radiographic film (iv) to check the effect of safe light on exposed as well as unexposed x-ray film.

PAPER-III
PATIENT CARE IN RADIOGRAPHY

1. THE RADIOGRAPHER AS A MEMBER OF THE HEALTH CARE SYSTEM/TEAM

The Health Care Team
Ethical and Medico legal Consideration Code of Ethics
Self Care
Care of supplies and equipment Patient rights
Malpractice

2. ATTITUDES AND COMMUNICATION IN PATIENT CARE

The Health illness Continuum Developing professional attitudes
Dealing with dying and death Communication with patients Challenges
in communication Children and adolescents Geriatric patients
Altered states of consciousness Patients who do not speak Vernacular
language
Communications with patients "Families" Communications with co-
workers
The chart as a resource
Problems-oriented medical recording Routine communication

3. SAFETY, TRANSFER AND POSITIONING

Fire prevention In case of fire
Other common hazards Body mechanics Patient transfer
Wheel chair transfer Stretcher transfer
Positioning for safety comfort Skincare
Safety straps and rails
Restraints and immobilization methods Accidents and incidents'
reports

4. EVALUATING AND MEETING PHYSICAL NEEDS

Meeting personal needs Serving as a physician stander Current status
Physical signs Vital signs
INFECTION CONTROL
The cycle of infection
Infectious organisms
The reservoir of infection
The susceptible host Transmission of disease Practical asepsis

Handling linen
Disposal of contaminated waste
Environmental asepsis
Isolation technique
The isolation patient in radiology department
Precaution for the compromised patient Surgical asepsis

5. MEDICATION AND THEIR ADMINISTRATION

The role of the radiographer Medication information
The topical route
The oral route
The parenteral route Preparation of injection
The intravenous route Charting

6. DEALING WITH ACUTE SITUATIONS

Accident victims
Head injury
Spinal injury
Extremities fracture Wounds
Burns
Oxygen administration
Life threatening emergencies Respiratory arrests
Heart attacks and cardiac arrests
Shocks
Other medical emergencies Nausea
Epitaxis
Postural hypotension and vertigo Seizures
Diabetic coma and insulin reaction Asthma
Wound dehiscence Multiple emergencies

7. PREPARATION AND EXAMINATION OF THE GASTROINTESTINAL TRACT

Preparations for examination Diet
Cathartics Enemas
Contrast media for gastrointestinal examinations Barium sulphate
Iodinated media Air contrast
Examination of the lower gastrointestinal tract Barium enemas Double
contrast barium enemas Upper gastrointestinal studies
Routine upper gastro intestinal studies Double contrast gastrointestinal
studies Hypotonic Duodenography
Ensuring compliance with preparation orders Follow up care

Scheduling sequencing of examination

8. CONTRAST MEDIA AND SPECIAL IMAGING TECHNIQUES

Iodinated contrast media

Aqueous iodine compounds for intravascular injection Reaction to contrast media

Contrast examination of the urinary examination IVU

9. CYSTOGRAPHY

Retrograde pyelography

Contrast examination of the biliary system Oral cholecystography

Intravenous cholangiography IPTC

10. T-TUBE

Other common contrast examination Myelography

Contrast arthrography Bronchography Angiography

Skin preparation

Special imaging techniques Computed tomography Diagnostic medicine sonography Nuclear medicine Mammography, Thermography

11. BEDSIDE RADIOGRAPHY SPECIAL CONDITION AND ENVIRONMENTS

Mobile radiography Orthopaedic traction Orthopaedics bed frames The ICU Tracheostomies Nasogastric tubes Closed chest drainage Swan ganzcatheters

The neonatal nursery The surgical suite

PAPER-IV

BASIC RADIOGRAPHIC TECHNIQUE-1 RADIOGRAPHY TECHNIQUES

- a. Skeletal system: Radiography techniques for X-ray of:
- b. Upper limb with special reference to hand wrist joint, and elbow joint, Supplementary techniques for carpal tunnel, scaphoid bone fracture, head of radius and supra-condylar projections.
- c. Lower limb which includes all the bones with special reference to ankle joints, knee joint, patella, techniques for calcaneum bone, supplementary techniques for flat foot, intercondylar notch and femur and metatarsals, etc.
- d. Shoulder girdle and thorax,
- e. Vertebral column with special techniques for cervical spine, inter-vertebral joint and foramina, Lumbosacral joint.
- f. Pelvic girdle and hip region.
- g. Respiratory system Chest radiography for both the lungs, apical, lordotic and oblique views, lateral views techniques to demonstrate fluid levels, effusion in the thoracic cavity, decubitus AP and of the lower gastrointestinal tract.

Physics

1. First year Physics for Radiographers - Hay & Hughes.
2. Basic radiological physics-K.Thayalan, Jaypee publishers (P) Ltd, New Delhi(2001)
3. Fundamental of X-ray and Radium Physics - Joseph Selman
4. Basic Medical Radiation Physics -Stanton.
5. Christensen's Physics of Diagnostic Radiology -Christesen.

Radiographic imaging

1. Radiographic imaging-Derrick P. Roberts and Nigel L. Smith. Churchill Livingstone, Edinburgh (1994)
2. Radiographic Latent image processing - W. E. J. McKinney
3. Photographic processing, quality control and evaluation of photographic material -J.E. Gray
4. Photographic processing Chemistry - L.F.A. Mason.
5. Physical and photography principles of Medical Radiography-Seeman & Herman.
6. Radiographic Imaging - Chesney & Chesney, Blakwell scientific publications, oxford (1981)

Subsidiary Subjects

FIRST YEAR

SI No	Subject	Teaching hours
1	Computer basics	20
2	English and Communication Skills	20
3	Health care	20
4	Basic Science with Skill Development Training and Hospital Procedure and Records	40

FIRST YEAR

I. COMPUTER BASICS

Teaching Hours: 20

1. Introduction to Computers
2. Definition: Input. Output & CPU
3. Input and output devices: types
4. Basis of computer system: Switching on & off, what is Bias? And computer generations
5. Keyboard practices
6. Definitions of terms: Desktop & Software
7. Computer systems: Hardware & software definitions
8. Windows operating system (win7, 8, 10 etc): Definition & Why, Calculator - Word pad - Short cuts - Start menu - Media player - Note pad - Win amp - Paint - Control panel
9. Microsoft word: Opening, saving, deleting, typing, print , Page border, spelling, table, grammar, margin, Clip art, BIU, word art, Colour text & background, Picture drawing using word
10. Excel: Formulas - Design charts- Format tables
11. PowerPoint: Designing a presentation - Inserting some animation with sound
12. Internet & its applications: Interconnection to HTML, E- mailing - Browsing - Chatting

II. ENGLISH AND COMMUNICATION SKILLS

Teaching Hours: 20

ENGLISH

1. Functional English –Grammar: Components of a sentence – Verb - Transformation of sentences – Voice - Reported speech - Positive/negative -Statement/ Interrogative - Subject verb agreement - Common errors – Exercises
2. Vocabulary: Synonyms and antonyms - Idioms and phrases – Similies - Words denoting assemblage
3. Writing skills: Note making – Summarizing - Report writing - Letter writing - Expansion of an idea
- Comprehension
4. Reading: What is efficient and fast reading? - What is Awareness of existing reading habits - Tested techniques for improving speed - Improving concentration and comprehension through systematic study

COMMUNICATION

5. Introduction: Communication process - Elements of communication - Barriers of communication and how to overcome them.
6. Speaking: Importance of speaking efficiently - Voice culture - Preparation of speech - secrets of good delivery - Audience psychology handling - Presentation skills - Conference/Interview technique
7. Listening: Importance of listening - Self-awareness about listening -Action plan execution - Barriers in listening - Good and persuasive listening
8. Nonverbal Communication: Basics of nonverbal communication
9. Memory: What is memory, Brain- mind potential? - Systems for memorizing
- Summary page
- Building positive mental habits
10. Self-awareness: Self-image - Self talk – Relaxation - Personality development

III. HEALTH CARE

Teaching Hours: 20

1. **Introduction to Health:** Definition of Health, Determinants of Health, Health Indicators of India, Health Team Concept, National Health Policy, National Health Programmes (Briefly Objectives and scope) Population of India and Family welfare programme in India
2. **Introduction to Nursing**
 - Nursing principles. Inter-Personnel relationships. Bandaging: Basic turns; Bandaging extremities; Triangular Bandages and their application. Nursing Position, Bed making, prone, lateral, dorsal, dorsal recumbent, Fowler's positions, comfort measures, Aids and rest and sleep. Lifting and Transporting Patients: Lifting patients up in the bed. Transferring from bed to wheel chair. 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
3. **First Aid:** Syllabus as for Certificate Course of Red Cross Society of St. John's Ambulance Brigade.

Reference Books:

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

IV. BASIC SCIENCE WITH SKILL DEVELOPMENT TRAINING AND HOSPITAL PROCEDURE AND RECORDS

Teaching Hours: 40

1. **Basic science with skill development training**
 - Medical ethics & the relevant medico legal aspects

- Responsibilities & duties
- Ethical behaviour & conduct
- Medico-legal aspects and its relation to consumer protection act
- Biomedical waste & Its management
- Cardiopulmonary resuscitation- basic cardiac life support & advanced cardiac life support
- Critical care nephrology - management of renal failure in ICU
- Basic principles of blood transfusion & fluid therapy
- Sterilization - material & methods
- Biochemistry, Microbiology, Pathology & other related instrumentation:
Basic principles of commonly used instruments, care & maintenance

2. Infection control

- The cycle of infection
- Infectious organisms
- The reservoir of infection
- The susceptible host Transmission of disease Practical asepsis
- Handling linen
- Disposal of contaminated waste
- Environmental asepsis
- Isolation technique
- The isolation patient in radiology dept.
- Precaution for the compromised patient Surgical asepsis

3. Medication and their administration (nursing classes)

- The role of the radiographer Medication information
- The topical route
- The oral route
- The parenteral route Preparation of injection
- The intravenous route Charting

4. Dealing with acute situations (emergency medicine classes)

- Accident victims: Head injury/ Fractures/ Burns
- Life threatening emergencies: Respiratory arrests, Heart attacks and cardiac arrests, Shocks
- Other emergencies - Epitaxis, Postural hypotension and vertigo
Seizures, Diabetic coma and insulin reaction Asthma

5. CARDIOPULPONARY RESUSCITATION (C.P.R)

- Basics of CPR - How to give CPR? Precautions during CPR

- Basic cardiac life support & advanced cardiac life support

6. HOSPITAL PROCEDURE AND RECORDS

General idea about the role, importance and procedures of the following within the hospital set up -

- Medical records
- Medical photography
- Computer networking system
- Laboratory services
- Sample collection and transport
- Biomedical waste disposal

**SECOND YEAR
BACHALORE OF SCIENCE
IN
MEDICAL IMAGING TECHNOLOGY
(2nd B. Sc. MIT)**

OUTLINES OF SYLLABUS FOR SECOND YEAR

PAPER-I

1. Physiology and Systemic pathology

SUBJECT – PHYSIOLOGY

Teaching hours; Theory: 70 Hrs. Practical: 10 Hrs: Total: 80 hrs

THEORY:

Sl. No.	CONTENT	Teaching hours
1	General Physiology- Homeostasis. Cell- structure, organelles, cell junctions, stem cells, cell aging and death.	3 hours
2	BLOOD: Composition and function of blood Red blood cells – Erythropoiesis, stages of differentiation, function, count, physiological Variation. Haemoglobin – structure, function, concentration, physiological variation, Methods of Estimation of Hb. White blood cells – Production, function, life span, count, differential count Platelets – Origin, normal count, morphology functions. Plasma Proteins – Production, concentration, types, albumin, globulin, Fibrinogen, prothrombin functions. Haemostasis & Blood coagulation Haemostasis – Definition, normal haemostasis, clotting factors, mechanism of clotting, disorders of clotting factors. Blood Bank Blood groups – ABO system, Rh system Blood grouping & typing. Cross matching Rh system – Rh factor, Rh incompatibility. Blood transfusion – Indication, universal donor and recipient concept. Selection criteria of a blood donor. Transfusion reactions Anticoagulants – Classification, examples and uses Anaemia: Classification – morphological and etiological. Effects of anaemia on body	14 hours
	Blood indices – Colour index, MCH, MCV, MCHC Erythrocyte sedimentation Rate (ESR) and Packed cell volume	

	<p>Normal values, Definition. Determination Blood Volume -Normal value, determination of blood volume and regulation of blood volume. Body fluid- pH, normal value, regulation and variation Lymph – lymphoid tissue formation, circulation, composition and function of lymph</p>	
3	<p>MUSCLE: Classification of muscle, structure of skeletal muscle, Sarcomere, contractile proteins, Neuromuscular junction. Transmission across Neuromuscular junction. Excitation contraction coupling. Mechanism of muscle contraction, muscle tone, fatigue. Rigor mortis.</p>	3 hours
4	<p>GASTRO INTESTINAL TRACT: Physiological anatomy of Gastro intestinal tract Functions of digestive system. Salivary glands - Structure and functions. Deglutition –stages and regulation Stomach – structure and functions. Gastric secretion – Composition, function, regulation of gastric juice secretion. Pancreas – structure, function, composition, regulation of pancreatic juice Liver – functions of liver. Bile- secretion, composition, function, regulation of bile secretion. Bilirubin metabolism, types of bilirubin, Vandenberg reaction, Jaundice- types, significance. Gall bladder – functions. Intestine – small intestine and large intestine. Small intestine –Functions- Digestion, absorption, movements. Large intestine – Functions, Digestion and absorption of Carbohydrates, Proteins, Fats, Lipids. Defecation.</p>	6 hours
5	<p>EXCRETORY SYSTEM: Excretory organs- Kidneys: Functions of kidneys. Structural and functional unit nephron, vasa recta, cortical and juxta medullary nephrons – Comparison, Juxta Glomerular Apparatus –Structure and function. Renal circulation peculiarities.</p>	6 hours

	<p>Mechanism of Urine formation: Ultrafiltration- criteria for filtration, GFR, Plasma, fraction, EFP, factors affecting GFR. Determination of GFR</p> <p>Selective reabsorption- sites of reabsorption, substance reabsorbed, mechanisms of reabsorption Glucose, urea, H + Cl, amino acids etc. TMG, Tubular load, Renal threshold % of reabsorption of different substances.</p> <p>Selective secretion.</p> <p>Properties and composition of normal urine, urine output. Abnormal constituents in urine. Mechanism of urine concentration.</p> <p>Counter – Current Mechanisms: Micturition, Innervation of Bladder, Cystourethrogram. Diuretics: Water, Diuretics, osmotic diuretics, Artificial kidney. Renal function tests – plasma clearance. Actions of ADH, Aldosterone and PTH on kidneys.</p>	
6	<p>ENDOCRINE SYSTEM:</p> <p>Definition, Classification of Endocrine glands & their Hormones. Properties of Hormones.</p> <p>Thyroid gland hormone – Physiological, Anatomy, Hormones secreted, Physiological function, regulation of secretion. Disorders – hypo and hyper secretion of hormone</p> <p>Adrenal gland- Adrenal cortex- Physiologic anatomy of adrenal gland, Adrenal cortex, cortical hormones – functions and regulation</p> <p>Adrenal medulla – Hormones, regulation and secretion. Functions of Adrenaline and Nor Adrenaline</p> <p>Pituitary hormones – Anterior and posterior pituitary hormones, secretion, function.</p> <p>Pancreas – Hormones of pancreas. Insulin – secretion, regulation, function and action.</p> <p>Diabetes mellitus – Regulation of blood glucose level.</p> <p>Parathyroid gland – function, action, regulation of secretion of parathyroid hormone.</p> <p>Calcitonin – function and action</p>	6 hours
7	<p>REPRODUCTIVE SYSTEM:</p> <p>Function of Reproductive system, Puberty</p> <p>Male reproductive system- Functions of testes,</p>	4 hours

	<p>spermatogenesis site, stages and factors influencing semen. Endocrine functions of testes Androgens – Testosterone structure and functions. Female reproductive system. Ovulation, menstrual cycle. Physiological changes during pregnancy, pregnancy test. Lactation: Composition of milk factors controlling lactation.</p>	
8	<p>CARDIO VASCULAR SYSTEM: Heart – Physiological Anatomy, Nerve supply Properties of Cardiac muscle Cardiac cycle-systole, diastole. Intraventricular pressure curves. Cardiac Output – definition, factors affecting. Heart sounds- Normal heart sounds. Areas of auscultation. Blood Pressure – Definition, normal value, clinical measurement of blood pressure. Physiological variations, regulation of heart rate, cardiac shock, hypotension, hypertension. Pulse – Jugular, radial pulse, Triple response Heart sounds – Normal heart sounds, cause, characteristics and significance. Heart rate Electrocardiogram (ECG) –significance.</p>	6 hours
9	<p>RESPIRATORY SYSTEM: Functions, Physiological Anatomy of Respiratory system, Respiratory tract, Respiratory Muscles, Respiratory organs, Alveoli, Respiratory membrane, stages of respiration.</p> <p>Mechanism of normal and rigorous respiration. Forces opposing and favouring expansion of the lungs. Intrapulmonary pleural pressure, surface tension, recoil tendency of the wall.</p> <p>Transportation of Respiratory gases: Transportation of Oxygen: Direction, pressure gradient, Forms of transportation, Oxygenation of Hb. Quantity of Oxygen transported.</p> <p>Lung volumes and capacities - Regulation of respiration. Mechanisms of Regulation- Neural and Chemical regulation. Respiratory centre. Hering Breuer Reflexes.</p>	6 hours

	Applied Aspects: Hypoxia, Cyanosis, Asphyxia, Dyspnoea, Dysbarism, Artificial Respiration, and Apnoea.	
10	<p>NERVE, CENTRAL NERVOUS SYSTEM:</p> <p>Functions of Nervous system, Neuron structure, classification and properties.</p> <p>Neuroglia, nerve fibre, classification, conduction of impulses continuous and saltatory. Velocity of impulse transmission and factors affecting.</p> <p>Synapse – structure, types, properties.</p> <p>Receptors – Definition, classification, properties.</p> <p>Reflex action – unconditioned properties of reflex action.</p> <p>Babinski’s sign. Spinal cord nerve tracts. Ascending tracts, Descending tracts</p> <p>Pyramidal tracts – Extrapyramidal tracts. Functions of Medulla, pons, Hypothalamic, disorders. Cerebral cortex lobes and functions, Sensory cortex, Motor cortex, Cerebellum, functions of Cerebellum. Basal ganglion-functions. EEG.</p> <p>Cerebro Spinal Fluid (CSF): formation, circulation, properties, composition and functions lumbar puncture.</p> <p>Autonomic Nervous System: Sympathetic and parasympathetic distribution and functions and comparison of functions.</p>	8 hours
1	<p>SPECIAL SENSES:</p> <p>1 Vision – structure of eye. Function of different parts. Structure of retina, visual pathway, accommodation, visual acuity, errors of refraction, colour vision.</p> <p>Hearing- structure and function of Ear. Mechanism of hearing, hearing tests.</p> <p>Taste & Smell: receptors, pathways, method of transduction.</p>	6 hours
1 2	<p>Skin –</p> <p>Structure and function.</p>	2 hours

	Body temperature measurement, Physiological variation, Regulation of body Temperature. Role of Hypothalamus, Hypothermia and fever.	
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LIST OF PRACTICALS: 10 Hours

1. Blood pressure Recording- Demo.
2. Auscultation for Heart Sounds- Demo.
3. Artificial Respiration- Demo.
4. Determination of vital capacity- Demo.

TEACHING LEARNING ACTIVITIES:

The course content in Physiology will be covered by:

1. Interactive Lectures
2. Group Discussions
3. Practical
4. Demonstrations
5. Seminars
6. Assignments

TEXT BOOKS RECOMMENDED

Latest editions of the following books:

1. Text book of Medical Physiology by Guyton(AC)
2. Chatterjee (CC) Human Physiology. Latest Ed.
3. Choudhari (Sujith K) Concise Medical Physiology Latest Ed. New Central Book.
4. Review of Medical Physiology by Ganong.
5. Anatomy & Physiology – Asha Lata

SYSTEMIC PATHOLOGY

1. RBC and Bleeding disorders: Anaemia – Definition and classification, Haemolytic anaemia, Iron deficiency anemia, Thrombocytopenia, Coagulation disorders – Terminology, Uses of Bleeding Time, PT and a PTT
2. WBC disorders: Leukocytosis, Leukemia – acute and chronic, Causes of splenomegaly
3. Disease of the GIT: Peptic ulcer – causes; Carcinoma stomach – causes; Intestinal obstruction – causes; acute appendicitis – causes; Colonic carcinoma - causes
4. Diseases of Liver, Biliary tract and Pancreas: Jaundice – classification based on pathophysiology; Cirrhosis – Definition and causes; Hepatitis – Types of viral hepatitis and transmission; Portal hypertension – Symptoms; Hepatic failure
5. Endocrine System: Diagnostic criteria of diabetes mellitus, Major subtypes of diabetes mellitus, Differences between type I and Type II diabetes mellitus, Complications of diabetes mellitus
6. Systemic Path emphasis I
7. Blood vessels: Atherosclerosis – Risk factors; American Heart association classification (1995) of Human atherosclerosis ; Hypertension – diagnostic criterion, types and causes ; Varicose veins; Thrombophlebitis and Phlebothrombosis
9. The Heart: Heart failure; congenital heart diseases causing left to right shunt and viceversa; Myocardial infarction – causes, laboratory changes and complications; Cor- pulmonale; Rheumatic fever
10. Diseases of the Lung: Chronic obstructive pulmonary disease; Asthma – pathogenesis; Pneumonia – lobar and bronchopneumonia; Lung carcinoma – Incidence and Causes
11. Systemic Path emphasis II
12. The Kidney and Lower urinary tract: Acute Renal failure – definition and causes of Pre- renal, renal and post-renal ARF ; Chronic renal failure – definition and causes; Acute nephritic syndrome – definition and causes; Nephrotic syndrome – definition and causes; Acute tubular necrosis – definition and causes; Urolithiasis – types of stones
13. Systemic Path emphasis III Female genital tract : Endometriosis – Definition ;
14. Adenomyosis – Definition; Leiomyoma Male genital tract : Carcinoma penis – causes; Testicular tumors – Classification terminology; Prostatic Hyperplasia – Causes, symptoms and PSA screening
15. Systemic Path emphasis IV Nervous system : Intracerebral, Subarachnoid and Subdural haemorrhage, Meningitis and Encephalitis – Bacterial and viral causes and CSF findings; Epilepsy – Causes; Acute brain failure – Coma; Epilepsy –

Classification terminology; CNS tumors – Classification terminology

EXAMINATION PATTERN:

Distribution of Marks for University Theory and Practical Exam

SCHEME OF EXAMINATION: Marks distribution: Physiology 50+ Pathology 20= 70
Marks Theory exam

Paper	Subjects	Theory		*Practical/Viva		Total
		UE	IA	UE	IA	
1	Physiology	50	10	-	10	70
2.	Pathology	20	10		00	30

*There shall be NO University practical examination in Physiology.

PATTERN OF QUESTION PAPER:

There shall be one theory paper carrying 70 marks. Distribution of type of questions and marks for Physiology shall be as given under.

EXAMINATION PATTERN

PATTERN OF THEORY QUESTION PAPER

Physiology

LONG ESSAYS (ANSWER ANY 1 OUT OF 2) 1X10 = 10 marks

SHORT ESSAYS (ANSWER ANY 4 OUT OF 6) 4X5 = 20 marks

SHORT ANSWERS (ANSWER ALL) 10X2 = 20 marks

Pathology

SHORT ESSAYS (ANSWER ANY 2 OUT OF 3) 2X5 = 10 marks

SHORT ANSWERS (ANSWER ALL) 5X2 = 10 marks

TOTAL

70 marks

Examiner: One internal and external examiner for university examinations

PAPER II

EQUIPMENT FOR RADIODIAGNOSIS-I

The following topics will be taken up:

a. High Tension Generators:

The self rectified high tension circuit. The half waves. Rectified circuit
The four valve full wave rectified circuit three phase full wave rectified circuit.
Voltage waveforms in high tension generators. Constant potential circuits
Rectifiers—valves and solid state.
The high frequency generators, advances and newer development.

b. The X-ray Tube:

General features of the x-ray tube. The fixed anode-x-ray tube Rotating anode –
x-ray tube.
Rating of x-ray tube.
Focal spot sizes.
Methods of heat dissipation of x-ray tubes. Common tube faults .
Developments in rotating anode tube. Tube stands and ceiling tube supports.

c. Components and control in the x-ray circuits:

The high tension transformer The rectification of high tension.
The control of kilovoltage, kilovoltage indication. The filament circuit and control
of tube current.
Exposure timers-electronic, automatic. Main voltage compensation
Mains supply and the x-ray set.

d. The Control of Scattered Radiation

Significance of scatter,
Beam limiting devices-cones, diaphragm (collimators). Beam centering devices.
The secondary radiation grid: its types, components of the grid, grid movements.
the assessment of the grid functions.

e. Portable and mobile x-ray units

Main requirement, portable x-ray machines and x-ray equipments for operation
theatre.

f. Fluoroscopic equipment

Structure of a fluorescent screen, The fluoroscopic image.
The fluoroscopic table, spot film devices and explorators. The protective
measure and physiology of vision.

g. Image intensifiers

Image intensifiers tube-its design , its application. The television process and the
television tube.
Recording of the intensified image.
T.V. monitors, video tape recording. The radiographic cameras.

h. Tomographic equipment's

Principle of tomography.

Various types of tomographic movements Multi section radiography.

Transverse axial tomography.

Equipment's for tomography

i. Equipment for rapid serial radiography.

The AOT changer.

The roll film, cut film changer, rapid cassette changer.

j. Equipment for cranial and dental radiography.

The skull table,

The general dental x-ray equipment. Specialized dental x-ray equipment.

PAPER III

PHYSICS FOR MEDICAL IMAGING

1. RADIATION PHYSICS:-

Structure of atom, electromagnetic radiation, production of x-rays, interaction of x-ray, absorbed dose, filtration

2. IMAGING WITH X-RAYS:-

Attenuation of x-rays by the patient, effect of scattered radiation, secondary radiation grid, magnification and distortion, unsharpness and blurring, tomography. Limitation of x rays tube

3. RADIOGRAPHY WITH FILMS AND GRIDS :-

Intensifying Screens ,films, characteristic curve, radiographic contrast, screen blurring, quantum mottle or noise, choice of exposure factor, macro-radiography, mammography, xeroradiography

4. FLUOROGRAPHY, DIGITAL IMAGING AND COMPUTED TOMOGRAPHY:-

Fluoroscopy, digital imaging, computed tomography, PACS

5. GAMMA IMAGING:-

Radioactivity, radioactive transformation, gamma imaging, radiopharmaceuticals, dose to the patient, precaution to be taken in the handling of radionuclide's, tomography with radionuclide's

6. IMAGING WITH ULTRASONUD:-

Piezoelectric effect, interference, single transducer probe, behavior of a beam at an interface between different materials, attenuation of ultrasound , A-mode, B-mode, Real time imaging,gray scale imaging, resolution, artifacts, M-mode, Doppler methods, safety consideration, quality assurance

7. MAGNETIC RESONANCE IMAGING:-

The spinning proton, the magnetic resonance signal, spin echo sequence, spatial encoding, magnetsand coils, other pulse sequence , characteristics of

the magnetic resonance image, artifacts, other nuclides, atomic magnetism, quality assurance, and hazards.

PAPER – IV

BASIC RADIOGRAPHIC TECHNIQUES II AND SPECIAL PROCEDURES

- 1. SKULL:-**
Radiography of cranial bones, cranium, sellturcica, orbit Optic foramina, superior orbital fissure and inferior orbital fissure
- 2. FACIAL BONES:-**
Para nasal sinuses, Temporalbone
- 3. DENTAL RADIOGRAPHY:-**
Radiography of teeth – intra oral, extra oral and occlusal view
- 4. ALIMENTARY TRACT:-**
Preparation of patient. General, acute positioning for fluid and air levels, Plain film examination, Radiography of female abdomen to look for pregnancy: intravenous Pyelography and cystography.
- 5. MACRORADIOGRAPHY:-**
Principal, advantage, technique and applications
- 6. STEREOGRAPHY :-**
Procedure, presentation for viewing, stereoscopes, stereo-metry
- 7. SOFT TISSUE TECHNIQUE:-**
Mammography, localization of foreign bodies,
- 8. WARD MOBILE RADIOGRAPHY :-**
Electrical supply, radiation protection equipment and instructions to be followed for portable radiography
- 9. OPERATION THEATRE TECHNIQUES :-**
General precautions , Aspects in techniques, checking of mains supply and functions of equipment, selection of exposure factors explosion risks , radiation protection and rapid processing techniques.
Radiological procedures pertaining to salivary glands, lacrimal system. Braonchography, arthrography and hysterosalpangiography-various requirements trolley set up, indications and contra indications, contract media used.
- 10. Ventriculography and encephalography-**
Technique, contrast media used, film sequence, indication and contraindications.
- 11. Myelography:**

Technique, contrast media used, injection of contrast media indications and contra indications.

12. Intra venous cholangiography.

T.Tube: Cholangiography, peroperative cholangiography, procedure, contrast media, indication and contra indications.

13. Double contrast Barium studies:

(small bowel enema, Ba Enema etc.) procedure, requirements, indications, contra indications and contrast media used.

14. Angiography: Cerebral, cardiac, abdominal aortography, general, renal and selective renal. Splenoportovenography Peripheral, arterial and venous angiography, precautions, radiation protection, film changers, manual automatic biplane, film type, - large, miniature, cine contrast media injection procedure and technique.

15. Intravental radiological procedures:

PTCPTBD, ERCP, fine needle aspiration cytology, percutaneous nephrostomy. Cardiac catheterization- embolization, dilation etc.

Reference books

- 1."Diagnostic Radiography" Glenda.J. Bryan (ELBS)
- 2."Positioning in Radiography" Clarks (CBS Publishers, New Delhi.).
- 3.Care of patient in diagnostic Radiography" Chesney & Chesney (Blackwell Scientific

SECOND YEAR Subsidiary subjects

Sl No	Subject	Teaching hours
1	Indian constitution	20
2	Sociology	20
3	Environment science and health	20
4	Clinical psychology	20

I. INDIAN CONSTITUTION

Teaching Hours: 20

1. Meaning of the term 'Constitution' Making of the Indian Constitution 1946-1950
2. The democratic institutions created by the constitution Bicameral system of Legislature at the Centre and in the States.

3. Fundamental Rights and Duties their content and significance
4. Directive Principles of States Policies the need to balance Fundamental Rights with Directive Principles.
5. Special Rights created in the Constitution for: Dalits, Backwards, Women and Children and the Religious and Linguistic Minorities.
6. Doctrine of Separation of Powers legislative, Executive and Judicial and their functioning in India
7. The Election Commission and State Public Service commissions
8. Method of amending the Constitution
9. Enforcing rights through Writs:
10. Constitution and Sustainable Development in India

Reference Books:

1. J.C. Johari: The Constitution of India- A Politico-Legal Study-Sterling Publication, Pvt. Ltd. New Delhi.
2. J.N . Pandey: Constitution Law of India, Allahbad, Central Law Agency, 1998.
3. Granville Austin: The Indian Constitution – Corner Stone of a Nation-Oxford, New Delhi, 2000.

II. SOCIOLOGY

Teaching Hours: 20

Course Description

This course will introduce student to the basic sociology concepts, principles and social process, social institutions [in relation to the individual, family and community and the various social factors affecting the family in rural and urban communities in India will be studied.

1. Introduction:

Meaning – Definition and scope of sociology. Its relation to Anthropology, Psychology, Social Psychology

Methods of Sociological investigations – Case study, social survey, questionnaire, interview and opinion poll methods.

Importance of its study with special reference to health care professionals

2. Social Factors in Health and Disease:

Meaning of social factors, Role of social factors in health and disease

3. Socialization:

Meaning and nature of socialization, Primary, Secondary and Anticipatory socialization, Agencies of socialization

4. Social Groups:

Concepts of social groups influence of formal and informal groups on health and sickness. The role of peoples involved in the primary and secondary health care groups in the hospital and rehabilitation setup.

5. Family:

The family, meaning and definitions, Functions of types of family, Changing family patterns. Influence of family on individual's health, family and nutrition, the effects of sickness in the family and psychosomatic disease and their importance to physiotherapy

6. Community:

Rural community: Meaning and features – Health hazards to rural communities, health hazards to tribal community.

Urban community: Meaning and features – Health hazards of urbanities

Culture and Health: Concept of Health Concept of culture and Health, Culture and Health Disorders

Social Change: Meaning of social changes, Factors of social changes, Human adaptation and social change, Social change and stress, Social change and deviance, Social change and health programme. The role of social planning in the improvement of health and rehabilitation

Social Problems of disabled: Consequences of the following social problems in relation to sickness and disability remedies to prevent these problems, Population explosion Poverty and unemployment Beggary, Juvenile delinquency Prostitution Alcoholism, Problems of women in employment

7. Social Security:

Social Security and social legislation in relation to the disabled

8. Social Work:

Meaning of Social Work, The role of a Medical Social Worker

Reference Books:

1. Sachdeva & Vidyabhushan, Introduction to the study of sociology
2. Indrani T.K., Text book of sociology for graduates nurses and Physiotherapy students, JP Brothers, New Delhi 10

III. ENVIRONMENT SCIENCE AND HEALTH

Teaching hours: 20

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

Recommended Books:

1. Text Book of Environmental Studies for under graduate courses By Erach Bharucha Reprinted in 2006, Orient Longman Private Limited /Universities Press India Pvt. Ltd.

IV. CLINICAL PSYCHOLOGY

Total teaching hours: 20

1. Introduction to psychology
2. Intelligence, Learning, Memory, Personality, Motivation
3. Body integrity- one's body image
4. Patient in his Milan
5. Self-concept of the therapist, Therapist patient relationship-some guidelines
6. Illness and its impact on the patients
7. Maladies of the age and their impact on the patient's own and others concept of his body image
8. Adapting changes in vision
9. Why Medical Psychology needs / demands commitment?

THIRD YEAR
BACHALORE OF SCIENCE
IN
MEDICAL IMAGING TECHNOLOGY
(3rd B. Sc. MIT)

OUTLINES OF SYLLABUS FOR THIRD YEAR

PART - III

PAPER – I: SPECIAL PROCEDURES IN RADIODIAGNOSIS, PLANNING AND QA IN RADIODIAGNOSIS

1. Radiological procedures pertaining to salivary glands, lachrymals system:

Bronchography, arthrography and hysterosalpingiography various requirements trolley set up, indications and contra indications, contrast media used

2. Ventriculography and encephalography:-

Technique, contrast media used, film sequence. indications and contra indications,

3. Myelography:- Technique,

contrast media used , injection of contrast media indications and contra indications

4. Intravenous cholangiography, T Tube:-Cholangiography, preoperative

cholangiography, procedure, contrast media , indication and contraindications.

5. Double contrast Barium studies:-

(small bowel enema , Ba Enema etc.) Procedure, requirements, indications, contra indications and contrast media used.

6. Angiography:-

Cerebral, cardiac, abdominal aortography, general, renal and selective renal. Splenoportovenography, peripheral, arterial and venous angiography, precautions, radiation protection, film changers, manual automatic biplane, film types- large, miniature, cine contrast media injection procedure and technique.

7. Interventional radiological procedures :- PTC, PTBD, ERCP , fine needle

aspiration cytology , percutaneous nephrostomy Cardiac catheterization – embolization , dilation etc.

6. Quality Assurance in Radiodiagnosis :- Aim of quality assurance in ,medical imaging,

Q.A. Programme i.e. phases of development of its radiological facility

Q.A.,activities applicable in.

- i) Equipment selection phase
- ii) Equipment installation of acceptance phase
- iii) Operational phase.

7. PLANNING IN RADIO-DIAGNOSIS:-

Location of the department Adjacent department and areas Basics of the imaging rooms Patient waiting areas
Basics infrastructures of the imaging rooms etc.

PAPER-II

Equipment for Radio – diagnosis including newer development

1. Computed tomography:

Historical developments , its principle and applications , various generations and definition of terms and cross sectional anatomy

2. Diagnostic Ultrasound:

Its principle, applications and role in medicine. Various types of transducers and definition of terms and cross sectional anatomy

3. Digital Radiography:

Principle, scanned projection radiography, digital subtractions angiography, applications and definition of terms.

4. MRI:

Principle, applications, its advantage over computed tomography or ultrasonography. Its limitations and uses and cross sectional anatomy.

5. NUCLEARIMAGING

6. PET – SCAN

7. PORTALIMAGING

PAPER – III
MODERN IMAGING TECHNOLOGY

1. ULTRASONOGRAPHY

Ultra sonography Doppler ultrasound
Doppler flow imaging, principle of ultrasound Types of transducers
Basics of Doppler ultrasound system

2. CTSCAN

Conventional CT Spiral CT
Basic principle CT Technique
Equipment description CT artifacts Indications Contraindications Contrast media used

3. MRI

Basic Principle Equipment description MR Angiography
MR artifacts Indications Contraindications Contrast media used

4. NUCLEAR MEDICINE

Definition
Contrast media / imaging material used Characteristics of radionuclide
Commonly used radio nuclides Descriptions of equipments
Imaging technology Uses and advantages

5. PET-SCAN

Definitions
Basic principle of PET-SCAN Equipment description Imaging materials used
Imaging technology Advantages PET- SCAN

6. MAMMOGRAPHY

Basic principle of mammography Equipment description
Imaging technology Importance
Uses and advantages

7. PORTAL IMAGING

Basic principle of portal imaging Devices
Imaging technology Advantages and uses Importance of portal imaging

8. INTERVENTIONAL RADIOLOGY

Definitions

Procedure of diff. types of procedure Imaging materials

Imaging technology Uses and importance

9. COMPUTED RADIOGRAPHY

Definitions

Basic principle of CR Imaging Plates Imaging Materials Imaging technology

Uses and importance

PAPER – IV

1. Radiation physics including radiation protection

Atomic structure as applied to generation of X-rays and radioactivity of diagnostic imaging and therapy X-rays. Effects of variation of tube voltage, current, filtration. HT waveform and target material on X-ray production. Law of radioactivity and decay schemes of different alpha, beta and gamma ray, negatron and positron emitters as used in medicine, especially in radiotherapy. Artificial radionuclide generators employed in medicine in general and radiotherapy sources in particular. Interaction of radiation with matter attenuation absorption and scattering phenomenon. Photoelectric absorption, Compton scattering, pair production and annihilation process, ionization, effects of geometry of thickness of the absorber. Dependence on the nature and Atomic number of the absorber and on radiation quality. Transmission of x-ray through body tissue. Linear energy transfer. Range of secondary electrons and electron build up. Relative amounts of scatter from homogeneous and heterogeneous beam during the passage through a patient. Physical requirements of beam during the passage through a patient. Physical requirements of beam defining devices

e.g. cones diaphragm, collimator etc. Units of radiation measurement specification of quality and half-value thickness (HVT) and its measurement filters and filtration. Measurement of radiation and dosimeter procedures. radiation detectors and their principles of working. Definition of Bragg-peak, percentage depth dose, peak scatter factor, tissue air-ratio, tissue maximum ratio scatter air ratio, is dose curves and radiation penumbra of different beams. Wedge filters, wedge angle, hinge angle. Compensators, beam flattening filters, scattering foils. Physical properties of phantoms, phantom materials, bolus and bolus substitutes. Factors used for treatment dose calculations, daily treatment time and monitor units calculation method. Physical aspects of electron and neutron beam therapy.

2. Radiation Protection:

Definition of radiation hazards maximum permissible dose and annual limit of intake (ALI), permissible dose levels on and around sealed source housing and installation principles of radiation protection and APD's of different IRCP rules , stochastic and non- stochastic effects . Importance of `ALARA' physical principle of design and planning of radiation installation. Safe work practice in teletherapy and brachytherapy . Shielding materials . Radiation survey and personnel monitoring devices film badges, TLD badges. pocket dosimeters in Head and neck cancer

Reference books

1. "Quality assurance in Diagnostic Radiology" By: J.M. Mclemore (Year book of Medical publishers).
2. ."Recent advances in Radiology and Medical Imaging" Lodge & Steiner (Churchill Livingstone)
3. "MRI for Technologists" Peggy Woodward & Roger F. Freimark (McGraw Hill)
4. Radiation Protection in Hospitals. Richard F. Mould
5. AERB safety code and manuals

Subsidiary Subjects

THIRD YEAR

SI No	Subject	Teaching hours
1	Research methodology	20
2	Biostatistics	20

THIRD YEAR

I. RESEARCH METHODOLOGY

Teaching hours:20

1. Introduction: Research Methodology

- Research process
- Steps involved in research process
- Research methods and methodology

2. Variables and scales of measurements

- Definitions and examples of qualitative, quantitative, continuous discrete, dependent and independent variable
- Definitions, properties and examples of nominal, ordinal, interval and ratio scales of measurements.

3. Sampling

- Population, sample, sampling, reasons for sampling, probability and non-probability sampling.
- Methods of probability sampling – simple random, stratified, systematic- procedure
- Merits and demerits.
- Use of random number table.

4. Organization of data

- Frequency table, histogram, frequency polygon, frequency curve, bar diagram, pie chart

5. Measures of location

- Arithmetic mean, median, mode, quartiles and percentiles – definition
- Computation (for raw data), merits, demerits and applications

6. Measures of variation

- Range, inter-quartile range, variance, standard deviation, coefficient of variation- definition
- Computation (for raw data), merits, demerits and applications

II. BIO-STATISTICS

Teaching hours:20

1. Introduction I: Biostatistics

- Definition
- Role of statistics in health science and health care delivery system

2. Normal distribution

- Concept, graphical form, properties, examples
- Concept of Skewness and Kurtosis

3. Correlation

- Scatter diagram
- Concept and properties of correlation coefficient, examples [No computation]

4. Health Information System

- Definition, requirement, component and uses of health information system.
- Sources of health information system- Census, Registration of vital events, Sample registration system (SRS), Notification of diseases, Hospital records, Disease registries, Record linkage, Epidemiological surveillance, Population survey

5. Vital statistics and hospital statistics

- Rate, ratio, proportion, Incidence, Prevalence. Common morbidity, mortality and
6. **Fertility statistics – Definition and computation.**
 7. **Hypothesis**
 - What is hypothesis
 - Formulation of hypothesis
 - Characteristics of good hypothesis.
 8. **Epidemiology**
 - Concept of health and disease
 - Definition and aims of Epidemiology,
 - Descriptive Epidemiology- methods and uses.
 9. **Concept of reliability & validity**

RECOMMENDED BOOKS

1. Methods in Biostatistics for medical students & Research workers, Mahajan B.K.- 6th edition
2. Research methodology – Methods & techniques, Kothari. C.R
3. Introduction to Biostatistics: A manual for students in health sciences, Sundar Rao PSS, Richard. J
4. Text book of Preventive and social medicine, Park. E. Park

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.
- 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.



SDM College of Medical Sciences & Hospital



SDM College of Dental Sciences & Hospital



SDM College of Physiotherapy &
SDM Institute of Nursing Sciences



Shri Dharmasthala Manjunatheshwara University



SDM Research Institute for Biomedical Sciences



Panoramic View of Campus