



Dr. M. G. R.

EDUCATIONAL AND RESEARCH INSTITUTE

UNIVERSITY

(Declared as Deemed to be University u/s. 3 of UGC Act, 1956)

MADURAVOYAL, CHENNAI – 600 095

FACULTY OF ALLIED HEALTH SCIENCE

**B.Sc. RADIOLOGY AND IMAGING
TECHNOLOGY**

Regulations, Curriculum and Syllabus

2017



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Regulations for B.Sc. (Allied Health Science) Courses

Introduction:

B.Sc. (Allied Health Science), a (3-year course work + 1-year internship) program under the **Faculty of Allied Health Sciences**, is aimed at training students who will be able to meticulously assist the doctors for providing quality patient care in selected areas of clinical specialty. This program is a taught course that covers relevant topics and specialized areas of knowledge as opted. The aim of this B.Sc. program is to provide a thorough training to the candidates through formal lectures and/or seminars and practical programs which culminate in a one year internship that finally prepares the student for the rigors of the medical world.

1. Short Title and Commencement:

These Regulations shall be called the “Regulations for B.Sc. (Allied Health Science) Course” of Dr. M.G.R Educational and Research Institute. These regulations shall come into force from the academic year 2017-2018. These regulations are subject to modifications as may be approved by the Academic Council from time to time.

2. Eligibility for Admission:

a) A candidate desiring to join the (3-year course work + 1-year internship) program, leading to the degree B.Sc. (Allied Health Science) should have passed the HSC/CBSE/ISC or equivalent examination with one of the following subject combinations:

- i) Physics, Chemistry, Biology
- ii) Physics, Chemistry, Botany and Zoology

b) A candidate shall, at the time of admission submit to the Head of the Institution, a certificate of medical fitness from an authorized Medical Officer certifying that the candidate is physically fit to undergo the academic course and does not suffer from any disability or contagious disease.

3. Age limit for admission

A candidate should have completed the age of 17 years or would complete the age as on 31stDecember of the year of admission to the BSc .Allied Health Science Course.

4. Eligibility Certificate

Candidates, who have passed any qualifying examination other than the Higher Secondary Course examination conducted by the Government of Tamil Nadu, shall obtain an Eligibility Certificate from Dr. M.G.R Educational and Research Institute and produce the same at the time of admission.

5. Registration

A candidate admitted to the course shall register his/her name with the University by submitting the application form for registration, duly filled in along with the prescribed fee, through the Head of the Institution within the stipulated date.

6. Duration of the course

The duration of the B.Sc. (Allied Health Science) Degree Course shall be 3-year course work comprising of 6(six) semesters and one year (semesters 7 & 8) of compulsory internship. The candidate is required to pursue the course on a full time basis, and must complete the course within seven years from the date of provisional registration.

7. Commencement of the Course:

The course shall ordinarily commence by the month of August of the academic year.

8. Curriculum:

The Curriculum and syllabus for the course shall be as specified in the annexure to these regulations which are subject to modifications by the standing Academic Board from time to time.

(i) The first three years of the course will be utilized as follows:

- The first two semesters will be spent on Pre and Para clinical subjects including Anatomy, Physiology, Biochemistry, Microbiology, Pathology, Physics , English and Communication skills, Introduction to Computers, and Pharmacology.
- At the beginning of the third semester, students will be assigned to one of the following branches of specialization as per the admission policy, and they will be offered specialized training in that specialty during the third, fourth, fifth and sixth semesters.

(ii) The fourth year of the course shall be compulsory internship in the respective specialty.

9. Medium of Instruction:

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

10. Working Days:

Each semester shall consist of not less than 100 working days and each academic year shall have a total of 200 working days or above in the first to Sixth Semesters. In the Seventh and Eighth semesters, each semester shall have a minimum of 120 working days.

11. Attendance:

The candidate shall have not less than 80 % attendance in Theory and Practical separately. Each semester shall be taken as a unit for the purpose of calculating the attendance. The candidate lacking attendance in a subject shall be denied permission to appear for the University Examination in that subject.

12. Condonation of Lack of Attendance:

The discretionary power of condonation of shortage of attendance to appear for University Examination rests with the University.

Lack of attendance can be condoned up to a maximum of 10% of the minimum attendance required in the following exceptional circumstances:

- (i) Any illness/ accident (for which Medical certificate from a registered medical practitioner must be produced)
- (ii) Any unforeseen tragedy in the family (should produce the letter from the parent/guardian)
- (iii) Participation in NCC/NSS and other co-curricular activities representing the Institution / University. (Certificate from competent authority is required)

For any of the above reasons, request shall be made by the candidate with prescribed fees to the Controller of Examination through proper channel, ten days prior to the commencement of the theory examination.

13. Commencement of the examinations

There shall be two sessions of University examinations in an academic year, viz., February and August.

14. Continuous (Internal) Assessment:

Continuous (Internal) Assessment for Theory shall be the average of the best two out of three.

Continuous (Internal) Assessment for Practical shall be the average of the best two out of three.

15. Semester - End Examination (University/Department):

- a. The examination in B.Sc. (Allied Health Science) shall consist of Written Theory examinations and Practical examinations. The Semester - End Examination (University/Department) shall be conducted at the end of each semester.

b. Papers for which Internal Examination is recommended by the Board of Studies and approved by the Academic Council, the date of Semester - End Examinations (Internal examinations) shall be as per the University guidelines.

16. Pattern of Semester - End Examination (University/Department):

EXAMINATION PATTERN

Semester-I and Semester-II (FOR ALL SPECIALITIES)

THEORY

2¹/₂ Hours

MAX.MARKS- 60 Marks **DURATION -**

PART –A (Answer any one from Two)

1. Essay (1x15=15 Marks)

PART-B (Answer all questions)

1. Short Notes (5x5=25 Marks)

PART-C (Answer all questions)

1. Short answers (10x2=20 Marks)

PRACTICAL

Practical (including Orals) 15 Marks

CONTINUOUS (INTERNAL) ASSESSMENT

(i) Theory 20 Marks

(ii) Practical 5 Marks

TOTAL - 100 Marks

Question pattern for SEMESTER III – SEMESTER VI

Duration -3hours

Theory Pattern

80 marks

Section –A (Answer any TWO from THREE)

1. Essay (2x15=30)

Section-B (Answer any EIGHT from TEN)

1. Short notes (8x5=40)

Section-C

1. Very short notes (5x2=10)

Internal assessment

20 marks

- **Based on CAT Exams**

TOTAL

100 Marks

Practicals Pattern

Max marks:80

- | | |
|------------------------------|----------|
| 1. Spotters | 20 marks |
| 2. Viva (Theory &Practicals) | 20 marks |
| 3. Charts/stations | 20 marks |
| 4. Record | 20 marks |

Internal assessment

Max marks:20

- Based on CAT Exams
- Attendance
- Log book

TOTAL

100 Marks

17. Marks Qualifying for a Pass:

For passing the University/End-Semester Examination from Semester I to Semester VI, the candidate shall secure the marks as stated below,

- (i) 40% minimum in the University End-Semester Theory examination
- (ii) 40% minimum in the University End-Semester Practical examination
- (iii) 40% of marks in the subject where internal evaluation alone is conducted
- (iv) 40% of aggregate of theory, practical and internal assessment taken together

18. Classification of successful candidates:

- a) Successful candidates who secure 75% marks and above as a course aggregate in the first appearance taking University theory, practical, and project/dissertation evaluation shall alone be awarded Distinction. This will also apply for award of University rank.
- b) Successful candidates who secure 60% marks and above as a course aggregate in the University theory, practical, project/dissertation evaluation and viva shall be awarded First Class.
- c) All others who secure 40-59% in gross percentage will be classified to have passed in Second Class.

19.Revaluation of answer papers

There shall be revaluation and retotaling of answer papers of failed candidates. Failed candidates are however, permitted to apply to the University within fifteen days of publication of the results for revaluation and retotaling.

20. Carry- over of failed subjects

- 1) A candidate has to pass in theory and practical examinations separately in each of the paper.
- 2) If the candidate fails either in theory or practical examinations, he/she has to reappear for both (theory and practical)
- 3) The student shall start the Internship training (VII & VIII semester) only after he/she clears all the papers from Semester I to Semester VI.

21. Temporary break of study

- a) A candidate is not normally permitted to temporarily break the study.
- b) If a candidate is continuously absent from the institute for four or more weeks,
 - i) Having notified the Dean/Director/Principal within this period, this absence shall be treated as “Temporary Break of Study”.
 - ii) Without notifying the Dean/Director/Principal, his/her name will be removed from the institute rolls.
- c) If a candidate is compelled to temporarily break the study for valid reasons (such as accident or hospitalization due to prolonged ill health), he/she shall apply for condonation of the break to the Dean/Director/Principal through the Head of the Department.
- d) For condonable break of study:
 - i) If the lack of attendance is within condonable limits as per Clause No. 12, the candidate shall be permitted to write the examination for the current semester.
 - ii) If there is non-condonable lack of attendance, the candidate shall rejoin the program at the respective semester as and when it is offered after the break and shall be governed by the rules and regulations in force at the time of rejoining.
- e) The total period for completion of the program reckoned from the commencement of the semester to which the candidate was first admitted shall not exceed the maximum period specified in Clause No.6 irrespective of the period of break of study in order that he/she may be qualified for the award of the degree.

f) In any case, a candidate shall be permitted to temporarily break the study only once during the entire duration of the program. The candidate shall forfeit the registration in case of a second break or in case of a non-condonable break of study.

g) Without prejudice to the above rules, the candidate who has completed the attendance requirement for a semester, but has proceeded on a condonable break of study without appearing for the University Examination, shall be permitted to appear for the examinations without repeating the semester and thereafter continue the subsequent semester.

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FACULTY OF ALLIED HEALTH SCIENCES
SCHEME OF EXAMINATION

SEMESTER – I

TOTAL HOURS : 330

S.No.	Paper	Hours/ Semester		Evaluation (Marks)				
		Theory	Practical	Continuous Assessment (Internals)		End Semester examination (University/Department Exams)		Total
				Theory	Practical	Theory	Practical	
1	Anatomy -I	40 hours	20 hours	20	5	60	15	100
2	Physiology -I	40 hours	20 hours	20	5	60	15	100
3	Biochemistry -I	40 hours	20 hours	20	5	60	15	100
4	Microbiology -I	40 hours	20 hours	20	5	60	15	100
5	Pathology -I	40 hours	20 hours	20	5	60	15	100
6	English	30 hours	-	50	15	20	05	50

SEMESTER – II

TOTAL HOURS : 400

S.No.	Paper	Hours / Semester		Evaluation (Marks)				
		Theory	Practical	Continuous Assessment (Internals)		End Semester examination (University/Department Exams)		Total
				Theory	Practical	Theory	Practical	
1	Anatomy -II	40 hours	20 hours	20	5	60	15	100
2	Physiology -II	40 hours	20 hours	20	5	60	15	100
3	Biochemistry -II	40 hours	20 hours	20	5	60	15	100
4	Microbiology -II	40 hours	20 hours	20	5	60	15	100
5	Pathology -II	40 hours	20 hours	20	5	60	15	100
6	Pharmacology	40 hours	20 hours	20	5	60	15	100
7	Physics	30 hours	-	50	-	-	-	50
8	Computer Science	30 hours	-	50	-	-	-	50

SCHEME OF EXAMINATION

SEMESTER – III (RADIOLOGY AND IMAGING SCIENCE TECHNOLOGY)

Total Hours: 420 Hrs

S.no	PAPER	Hours / Semester		Evaluation (Marks)				
		Theory	Practical	Continuous assessment (Internals)		End Semester Examination (University/ Department Exams)		Total
				Theory	Practical	Theory	Practical	
1.	Anatomy, Physiology, Pathology and Pharmacology related to Radiology- Theory (UE)	60 hours	-	20	-	80	-	100
2.	Anatomy, Physiology, Pathology and Pharmacology related to Radiology – Practical (UE)	-	120 hours	-	20	-	80	100
3.	Radiological Physics and Dark Room Techniques Theory (UE)	60 hours	-	20	-	80	-	100
4.	Radiological Physics and Dark Room Techniques Practical (UE)	-	120 hours	-	20	-	80	100
5.	Medical Ethics and Bio safety(IE)	30 hours	-	-	-	50	-	50
6.	Psychology (IE)	30 hours	-	-	-	50	-	50

SEMESTER – IV (RADIOLOGY AND IMAGING SCIENCE TECHNOLOGY)

Total Hours: 420 Hrs

S.no	PAPER	Hours / Semester		Evaluation (Marks)				
		Theory	Practical	Continuous assessment (Internals)		End Semester Examination (University/ Department Exams)		Total
				Theory	Practical	Theory	Practical	
1.	Radiology equipments -Theory (UE)	60 hours	-	20	-	80	-	100
2.	Radiology equipments- Practical (UE)	-	120 hours	-	20	-	80	100
3.	Positioning Radiography and Contrast Procedures - Theory (UE)	60 hours	-	20	-	80	-	100
4.	Positioning Radiography and Contrast Procedures- Practical (UE)	-	120 hours	-	20	-	80	100
5.	Basics and Advanced Life support (IE)	30 hours	-	-	-	-	50	50
6.	Sociology (IE)	30 hours	-	-	-	-	50	50

SEMESTER –V (RADIOLOGY AND IMAGING SCIENCE TECHNOLOGY)

Total Hours: 390 Hrs

S.no	PAPER	Hours / Semester		Evaluation (Marks)				
		Theory	Practical	Continuous Assessment (Internals)		End Semester Examination (University/ Department Exams)		Total
				Theory	Practical	Theory	Practical	
1.	Basic and Advanced Ultra Sound Imaging - Theory (UE)	60 hours	-	20	-	80	-	100
2.	Basic and Advanced Ultra Sound Imaging - Practical (UE)	-	120 hours	-	20	-	80	100
3.	Basic and Advanced CT Scan -Theory (UE)	60 hours	-	20	-	80	-	100
4.	Basic and Advanced CT Scan - Practical (UE)	-	120 hours	-	20	-	80	100
5.	Community medicine (IE)	30 hours	-	-	-	50	-	50

SEMESTER – VI (RADIOLOGY AND IMAGING SCIENCE TECHNOLOGY)

Total Hours: 390 Hrs

S.no	PAPER	Hours / Semester		Evaluation (Marks)				
		Theory	Practical	Continuous Assessment (Internals)		End Semester Examination (University/ Department Exams)		Total
				Theory	Practical	Theory	Practical	
1.	Basics and advanced MRI - Theory(UE)	60 hours		20		80		100
2.	Basics and advanced MRI - Practical(UE)		120 hours		20		80	100
3.	Interventional Radiological procedures and Basic angiography- Theory (UE)	60 hours		20		80		100
4.	Interventional Radiological procedures and Basic angiography - Practical (UE)		120 hours		20		80	100
5.	Healthcare and basic Principles(IE)	30 hours				50		50

SEMESTER – VII (FOR ALL SPECIALITIES)

Project/Dissertation

S.no	PAPER	Hours / Semester		Evaluation (Marks)				Total
		Theory	Practical	Continuous Assessment (Internals)		End Semester Examination		
				Project	Viva	Project	Viva	
1.	Project/ Dissertation	-	-	100	-	100	-	200
2.	Statistics and research methodology	30 hours	-	-	-	-	50	50

SEMESTER – VII & VIII (FOR ALL SPECIALITIES)

Internship -1 year

OBJECTIVES:

The course builds on the experience and skills of qualified radiographers, adding professional development skills and knowledge, and also provides for students to enhance their academic skills.

Radiology is the branch or specialty of Medicine that deals with the study and application of Imaging Technology like X-ray, MRI, Ultrasound and Radiation to Diagnosing and treating diseases. Radiology Technologists are Health Care Professional who perform diagnostic Imaging procedures and are responsible for accurately positioning patients and ensuring that a quality diagnostic image is produced. Radiology Technologist is also a very specialized skilled person with high knowledge on technology and its usage on high end machines in Radiology department. Radiology Technologists produce clear and accurate images of the body that enable physicians to diagnose and treat medical conditions that would otherwise be difficult to document. Radiology Technologists operate sophisticated high end equipment that includes X-ray, Ultrasound, Computerized Tomography (CT) and Magnetic Resonance Imaging (MRI) scan devices. They also assist Radiologist in many interventional procedures and well trained to handle emergencies.

SEMESTER I

S.no	SUBJECT
1	ANATOMY-I
2	PHYSIOLOGY-I
3	BIOCHEMISTRY-I
4	MICROBIOLOGY-I
5	PATHOLOGY-I
6	ENGLISH

SEMESTER - I

ANATOMY – I

COURSE DESCRIPTION:

- A study of the anatomical structure of the human body.
- Body structure will be studied by organ systems.
- Form-function relationships with emphasis on clinically relevant anatomy.
- The laboratory study will involve observing and learning from human skeletal collections and dissected cadavers and preserved specimens.

OBJECTIVES:

- **At the end of the course the student should be able to:**
- Describe the structure and functions of the organ systems of the human body.
- Describe how the organ systems function and interrelate.
- Learn basic technical terminology and language associated with anatomy.
- Develop a self-identity of what it means to be “human”.

LEARNING OBJECTIVES: SKILLS

- Identify the anatomical structure in the dissected specimen.
- Learn to correlate anatomical structures with relevant clinical conditions.

CONTENTS

UNIT I

Organization of the Human Body

- Introduction to the human body
- Definition and subdivisions of anatomy
- Anatomical position and terminology
- Regions and Systems of the body
- Cavities of the body and their contents
- Levels of organization of the body

Cell

- Definition of a cell, shapes and sizes of cells
- Parts of a cell – cell membranes cytoplasm, sub cellular organelles and their main function
- Cell Division – Definition and main events that occur in different stages of mitosis and meiosis.

Tissues

- Tissues of the body
- Definition and types of basic tissues
- Characteristics, functions and locations of different types of tissues

UNIT II

Systems of Support and Movement

1. Skeletal system

- Skeleton – Definition, axial and appendicle skeleton with names and number of bones, Types of bones. Parts of bones. Functions of bones. Name location and general features of the bones of the body.
- **Joints** – Definition and types of joints with examples. Axes and kind of movements possible. Name, location, type, bones forming, movements possible.

2. Muscular system

- Parts of the skeletal muscle. Definition of origin and insertion. Name and location of the skeletal muscles of the body. Origin, insertion, nerve supply and action of large muscles like sternocleidomastoid, pectoralis major, deltoid, Biceps brachii, Triceps brachii, gluteus, gastronemius and diaphragm.

UNIT III

Control Systems of the Body

1. Nervous system

- Sub-divisions of the nervous system
- **Spinal cord** – Location, extent, spinal segments, external features and internal structure.
- **Brain** – Sub-divisions, location external features of medulla oblongata, pons, mid-brain, cerebellum and cerebrum. Meninges and spaces around them. Name and location of ventricles of brain and circulation of cerebrospinal fluid. Blood supply of the brain and spinal cord.

- **Cranial nerves** - Name, number, location and general distribution.
- **Spinal nerves** - Typical spinal nerve groups and number of spinal nerves. Name and location of cervical plexus and brachial plexus. Location and general distribution of the branches.
- **Autonomic Nervous system** –definition and functions

2. Sense organs

- Location and features of the nose, tongue, eye, ear and skin

3. Endocrine system

- Names of the endocrine glands. Location and features of pituitary, thyroid, parathyroid, suprarenal, pancreas, ovaries and testes. Names of hormones produced by each gland.

PRACTICAL & VIVA VOCE SYLLABUS

- 1. Histology – Epithelium**
- 2. Axial & Appendicular Skeleton With Names & Number Of Bones**
- 3. Muscles**
 - a. Trapezius
 - b. Latissimusdorsi
 - c. Biceps
 - d. Triceps
 - e. Deltoid
 - f. Gluteus Muscles
- 4. Nervous System**
 - a. Cerebrum
 - b. Cerebellum
 - c. Brain Stem
 - d. Spinal Cord
- 5. Special Senses**
 - a. Tongue
 - b. Ear
 - c. Skin
 - d. Eye ball
- 6. Viva Voce**
 - a. Radiology – X-rays
 - b. Osteology
 - c. Charts
 - d. Models

Recommended books:

1. Manipal manual of Anatomy for Allied Health Sciences, Sampath madhyastha
2. B D Chaurasia: General human anatomy

References:

1. B D Chaurasia: Regional Anatomy. Vol I,II,III
2. Richard S. Snell: Clinical Anatomy

PHYSIOLOGY - I

OBJECTIVES OF THE COURSE:

At the end of this course the students should be able to:

- Comprehend basic terminologies used in the field of Human Physiology.
- Define and describe basic Physiological Processes governing the normal functioning of the human body.
- Apply this knowledge in their Allied Health Science practice.

CONTENTS

UNIT I

Ia. General physiology

- Concept of Homeostasis
- Cell structure and functions
- Transport across membranes

Ib. Nerve & muscle

- Nerve structure, classification of nerve fibres,
- Muscles-classification, structure, Neuro-Muscular junction (NMJ),
- Muscle contraction – mechanism, types.

Ic. Blood and body fluids

- Body fluid volumes, compartments, and composition
- Blood composition and functions
- Plasma proteins
- Erythrocytes – Morphology and functions
- Leucocytes – Morphology and functions
- Platelets-Morphology and functions
- Blood groups

UNIT II

IIa. Digestive system

- Salivary glands - Nerve supply, functions of saliva
- Gastric juice - composition & functions of gastric juice.
- Pancreatic juice – composition, functions and regulation of Pancreatic juice
- Bile – composition, functions of bile & bile salts.
- Succus entericus and small intestinal movements
- Deglutition, vomiting, functions of large intestine.

II b. Excretory system

- Structure of Nephron and its blood supply, Juxta Glomerular Apparatus (JGA)
- Formation of urine- Filtration, Reabsorption & Secretion
- Counter-Current mechanism
- Micturition

PRACTICAL AND DEMONSTRATION

1. Hemocytometer and Microscope
2. RBC
3. Blood Grouping
4. Charts and spotters

BIOCHEMISTRY- I

OBJECTIVES:

- To have a knowledge about the chemistry and metabolism of various macromolecules- carbohydrate, protein and lipids
- To learn about enzymes, vitamins, minerals and nutrition
- To know the structure and function of Hemoglobin, Nucleic acids.
- To learn about the organ function tests like Liver Function Tests and Renal Function Tests.

CONTENTS

UNIT I - CARBOHYDRATES

- Classification of carbohydrates and their biological importance,
- Reducing property of sugars.

Metabolism of Carbohydrates :

- Digestion and Absorption of carbohydrates,
- Steps of Glycolysis and energetics,
- Steps of TCA cycle and energetics,
- Steps of Glycogen synthesis and breakdown,
- Significance of HMP shunt pathway,
- Definition and steps of Gluconeogenesis, Galactose metabolism
- Galactosemia.
- Diabetes mellitus

Bioenergetics :

- Importance of ATP, Outline of respiratory chain.

UNIT II - LIPIDS

- Classification of lipids,
- Essential fatty acids,
- Functions of cholesterol,
- Triglycerides,
- Phospholipids

Metabolism of Lipids :

- Digestion and Absorption of lipids,
- Fatty acid synthesis & Steps of β oxidation of fatty acids,
- Types and functions of lipoprotein,
- Lipid profile, hyper cholesterolemia

UNIT III - VITAMINS

- Vitamins, its classification
- Vitamin A
- Vitamin D
- Vitamin E & K
- Vitamin B complex
- Vitamin C

UNIT IV - ENZYMES

- Definition,
- Classification,
- Coenzymes,
- Factors affecting enzyme activity, Types and examples of enzyme inhibition

BIOCHEMISTRY PRACTICALS

S.no.	PRACTICALS
1	Reactions of Glucose
2	Reactions of Fructose
3	Reactions of Maltose
4	Reactions of Lactose
5	Tests for Sucrose
6	Tests for Starch
7	Identification of unknown Carbohydrates
8	Spotters

BIOCHEMISTRY SPOTTERS

The student must identify the spotter and write some important uses of the spotter.

CRYSTALS

1. Maltosazone
2. Lactosazone
3. Glucosazone/Fructosazone

REAGENTS

1. Benedict's reagent
2. Barfoeds reagent
3. Foulgers reagent
4. Seliwanoff reagent
5. Fouchets reagent

CHEMICALS

1. Sodium Acetate
2. Phenylhydrazine
3. α Naphthol

STRUCTURES.

1. Structure of Cholesterol
2. Structure of Glucose
3. Structure of Fructose

STRUCTURES.

1. Carrots
2. Rickets
3. Scurvy
4. Egg

PATHOLOGY – I

CONTENTS

1. Introduction to cell

- Normal Cell Structure and functions

2. Cell injury and Adaptation

- Types of cell injury
- Adaptation
- Necrosis
- Apoptosis
- Pathological Calcification

3. Inflammation and Repair

- Acute Inflammation
- Chronic Inflammation
- Wound Healing and Repair

4. Infectious Disease

- TB
- Leprosy

5. Hemodynamic Disorders

- Edema
- Thrombosis and Embolism
- Shock

6. Neoplasia

- Classification
- Nomenclature
- Characteristics of Benign & Malignant Neoplasm
- Pathogenesis of Cancer
- Spread of Cancer

7. Genetic Disorders

- Down's Syndrome
- Klinefelter Syndrome
- Turner Syndrome

8. Radiation

- Biological Effect of Radiation

PRACTICALS

1. DIFFERENTIAL COUNT

- Spotter

2. GROSS (SPOTTER)

- Fatty liver
- Lipoma
- Dry gangrene foot
- Wet gangrene bowel
- CVC Spleen
- Hydatid cyst
- TB – Lung

3. INSTRUMENTS

- Westergrens ESR tube
- Sahli hemocytometer
- Neubaum's chamber
- Bone Marrow Needle

MICROBIOLOGY -I

OBJECTIVE:

At the end of the semester the students should be able to

1. Know the concepts of sterilization and disinfection procedures and their applications.
2. Understand the basic principles of immunology.
3. Understand the basic fundamental aspect of bacteria and study the common disease caused by them.

CONTENTS

UNIT I:

General Microbiology - History and Introduction of Microbiology, Microscopy and Morphology of bacterial cell and their function, Growth and nutrition of Bacteria, Sterilization and Disinfection , Culture media, Culture methods and Identification of bacteria.

UNIT II :

Immunology - Basic concept about Infection (Source, Portal of entry and Spread), Immunity, Antigen, Antibody, Antigen-Antibody reaction, Hypersensitivity.

UNIT III:

Systemic bacteriology- Disease caused and lab diagnosis of medically important bacteria (Staphylococcus, Streptococcus, Neisseria, Echerichia coli, Salmonella, Shigella, Vibrio, Mycobacteria, Spirochetes)

PRACTICALS

I. Gram staining

II. Spotters:

1. Disposable syringe
2. Sterile cotton swab
3. Bacteriological loop
4. Sterile tube
5. McIntosh fildes Jar
6. Autoclave
7. Nutrient Agar plate
8. Mac Conkey agar plate
9. Mac Conkey with LF
10. Mac Conkey with NLF
11. Blood agar plate
12. L J Media
13. RCM
14. BHI broth
15. Antibiotic susceptibility test
16. Gram Positive Cocci in Clusters
17. Gram negative bacilli
18. AFB
19. VDRL Slide
20. Microtitre plat

ENGLISH

GENERAL OBJECTIVES:

- To improve comprehensive and writing skills in English
- To discuss about effective communication skills
- To prevent barriers in communication.

1. Grammar

- Components of a sentence
- Positive and Negative statements
- Interrogative Statement
- Parts of speech in brief
- Transformation and synthesis of sentences
- Verb and Tense forms
- Voice
- Reported Speech
- Common errors and how to avoid them

2. Vocabulary

- Medical Terminology
- Words often confused or misused
- Words and expression in British and American English
- Idioms and Phrases

3. Oral communication

- Importance of speaking efficiently
- Voice culture
- Preparation of Speech
- Secrets of good delivery
- Audience Psychology
- Presentation Skills
- Using non-verbal communication
- Interview technique
- Skill in arguing

4. Spoken English

- The phonetic symbols
- Stress
- Intonation
- Rhythm
- Transcription
- Using dictionaries for learning to pronounce

5. Written communication

(a) Art of writing

- Rules for effective writing
- Expansion of proverbs & Ideas
- Précis writing

(b) Letter writing

- Private letters & Social letters
- Business letters
- Letter to a Bank
- Letter to a Newspaper
- Letter to Application
- Curriculum Vitae (Different models)
- Placing an order

(c) Report writing

- Guidelines to prepare a good report
- Usage of impersonal language
- Preparing lab reports

(d) Note making and Note taking

- Note making and note taking strategies
- Organizing notes
- Exercise and note making / taking

(e) Comprehension

- Listening and reading comprehension
(Exercise of prescribed short answers)

6. Reading

(a) What is efficient and fast reading?

(b) Awareness of existing reading habits

(c) Tested techniques for improving speed

(d) Improving concentration and comprehension through systematic study.

Reference Books:

1. English for Competitive Examinations by R.P.Bhatnagar, Rajiel Bhargava
2. English for college and competitive exams by Dyvadatham
3. Written Communication in English by Sarah Freeman
4. Writing with a purpose by Tickoo & Sasikumar
5. English phonetics for Beginners by P.Iyadurai
6. English through reading by W.Bhaskar and N.S.Prabhu
7. Empowerment through verbs & idioms by Padmini devkumar
8. High School English Grammer and Composition by Wren & Martin
9. Communication techniques for your success everywhere by Muralidharan

SEMESTER-II

S.no	SUBJECTS
1	ANATOMY-II
2	PHYSIOLOGY-II
3	BIOCHEMICAL-II
4	MICROBIOLOGY-II
5	PATHOLOGY-II
6	PHARMACOLOGY
7	MEDICAL PHYSICS
8	COMPUTER SCIENCE

SEMESTER – II

ANATOMY – II

CONTENTS

UNIT IV

Maintenance of the Human Body

1. Cardio-vascular system

- Types and general structure of blood vessels. Structure and types of arteries and veins. Structure of capillaries. Shape, size, location, coverings, external and internal features of heart. Structure of heart wall, conducting system of the heart.
- Blood supply of the heart. The systemic arteries and veins. Name, location, branches and main-distribution of principal arteries and veins.

2. Lymphatic system

- Lymph, lymphatic vessels, name, location and features of the lymphatic organs.

3. Respiratory system

- Names of organs of respiration, Location and features of nose, pharynx, larynx, trachea, bronchi, lungs and pleura.

UNIT V

4. Digestive system

- Names of organs of digestion. Parts of alimentary canal and accessory organs. Location and features of mouth, pharynx, esophagus, stomach, small and large intestines. Location and features of salivary glands, pancreas, liver and gall bladder.

5. Urinary system

- Names of urinary organs, location and features of kidney, ureter, urinary bladder and urethra.

UNIT VI

6. Reproductive system

- Names of male and female organs of reproduction. Location and features of scrotum, testis, epididymis, vas deferens, seminal vesicle, ejaculatory duct, prostate gland, penis and spermatic cord. Location and features of uterus and its supports, uterine tube, ovary vagina vulva and breast.

Anatomical Regions

- Simple ideas about scalp, triangles of neck, axilla, cubital fossa, mediastinum, inguinal canal, femoral triangle, popliteal fossa.

PRACTICAL & VIVA VOCE SYLLABUS

1. Endocrine System

- a. Pituitary gland
- b. Pineal body
- c. Thyroid & parathyroid gland
- d. Adrenal
- e. Pancreas
- f. Gonads – Ovary & Testis

2. Cardio -Vascular System

- a. Heart

3. Lymphatic system

- a. Spleen

4. Respiratory System

- a. Lungs
- b. Larynx
- c. Trachea

5. Digestive System

- a. Salivary glands
- b. Esophagus
- c. Pharynx
- d. Stomach
- e. Liver, Gall bladder
- f. Duodenum
- g. Small intestine
- h. Large intestine

6. Urinary system

- a. Kidneys
- b. Ureter
- c. Urinary baldder

7. Reproductive System

- a. Saggital section – Male & Female pelvis
 - i. Uterus & ligaments
 - ii. Ovary
 - iii. Prostate
 - iv. Seminal vesicals
 - v. Vas deferens
 - vi. Testis

8. Viva Voce

- a. Radiology – X rays
- b. Osteology
- c. Charts
- d. Models

Recommended books:

3. Manipal manual of Anatomy for Allied Health Sciences, Sampath madhyastha.
4. B D Chaurasia: General human anatomy.

References:

3. B D Chaurasia: Regional Anatomy. Vol I, II,III.
4. Richard S. Snell: Clinical Anatomy.

PHYSIOLOGY-II

CONTENTS

UNIT-III

Cardiovascular system

- Cardiac muscle, action potential & Conducting system of the heart
- Cardiac cycle
- ECG, heart sounds, Heart Rate
- Cardiac output-Definition, factors regulating cardiac output and measurement of cardiac output.
- Blood pressure – Definition, measurement, factors maintaining B.P, Regulation of B.P
- Regional circulation – Coronary and Cerebral.

UNIT-IV

Nervous system

- Structure & Properties of Neuron
- Nerve – Classification, injury
- Types and properties of Receptors
- Synapse and synaptic transmission,
- Reflex and its properties
- Spinal cord – Ascending & Descending tracts
- Thalamus, Basal ganglia, Cerebellum, Cerebral cortex, Hypothalamus & Cerebrospinal fluid
- Autonomic nervous system.
- Ascending and Descending tracts

UNIT -V

Respiratory system

- Structure of upper and lower respiratory tract. Muscles of respiration and Mechanism of respiration.
- Lung volumes and capacities – definitions, normal values, intra pulmonary and intra pleural pressures, surfactant
- Oxygen transport, Carbon-dioxide transport
- Neural and chemical regulation of respiration
- Hypoxia, cyanosis, Artificial Respiration

UNIT-VI

Special sense and skin

- Vision,
- Audition
- Olfaction
- Gustation

UNIT -VI

Reproductive system:

- Male reproductive organs - Spermatogenesis and Testosterone actions
- Female reproductive organs - Menstrual cycle
- Contraception Methods

UNIT-VII

Endocrine system

- Hypothalamo hypophyseal inter relationship
- Anterior pituitary hormones and their functions
- Posterior pituitary hormones and their actions
- Thyroid hormones, biosynthesis and functions
- Parathyroid hormones, functions
- Insulin, Glucagons, actions and Diabetes mellitus
- Adrenal cortex hormones and their functions.
- Adrenal medullary hormones and their actions

PRACTICAL AND DEMONSTRATION

1. WBC
2. Blood pressure
3. Bleeding time
4. Clotting time
5. Charts and spotters

BIOCHEMISTRY – II

UNIT V - PROTEINS

- Classification of amino acids,
- Structure of proteins,
- Plasma proteins,
- Immunoglobulins.

Metabolism of Proteins :

- Digestion and absorption of proteins,
- Transamination,
- Deamination,
- Steps of urea cycle,
- Phenylketonuria,
- Alkaptonuria,
- Transmethylation,
- Products derived from Glycine and tyrosine

UNIT VI -- NUCLEIC ACIDS

- Structure & Function of DNA,
- Structure, Its types & Functions of RNA
- Nucleic Acid Metabolism

UNIT VII - HAEMOGLOBIN

- Structure & Function of Haemoglobin
- Haemoglobin Metabolism

UNIT VIII-- MINERALS

- Macro & Minor Minerals & Metabolism

UNIT IX -- NUTRITION

- BMR, SDA & Glycemic Index
- Dietary Fibers & Balanced Diet
- Protein Energy Malnutrition

UNIT X -- ORGAN FUNCTION TEST

- LFT
- RFT

UNIT XI - ACID BASE BALANCE

- pH Homeostasis
- Buffers
- Acidosis
- Alkalosis

BIOCHEMISTRY PRACTICALS

S.NO.	PRACTICALS
1	Non- Protein Nitrogenous Substances
2	Analysis of Constituents of Normal urine
3	Analysis of Constituents of abnormal urine
4	Identification the constituents of Abnormal Urine
5	Estimation of Glucose in Blood
6	Estimation of Urea in Blood
7	Spotters

BIOCHEMISTRY SPOTTERS

Spotters: The student must identify the spotter and write some important uses of the spotter.

1. Urinometer
2. Lactometer
3. Centrifuge
4. Spectroscope
5. Colorimeter
6. pH meter
7. Ryles's Tube
8. Chromatography apparatus
9. Electrophoresis apparatus
10. Micropipette
11. Fluorosis
12. Inborn Errors of Metabolism
13. Protein Energy Malnutrition
14. Benzidine powder
15. Sulphur powder
16. Fouchet's Reagent
17. Structure of t RNA
18. Egg White
19. Jaundice
20. Gout

PATHOLOGY - I

1. CVS

- Atherosclerosis
- Ischemic heart disease
- Congenital heart disease
- Valvular heart disease

2. RESPIRATORY SYSTEM

- Bronchial Asthma
- Emphysema
- Bronchiectasis

3. GIT

- Gastric ulcer
- Tumors of GIT

4. HEPATOBILIARY

- Hepatitis
- Liver Abscess
- Cirrhosis
- Cholecystitis

5. KIDNEY AND URINARY TRACT

- Renal stones
- UTI and Pyelonephritis
- Renal cell carcinoma(RCC)
- Renal Failure

6. REPRODUCTIVE SYSTEM

- Diseases of testis, uterus, cervix and ovary

7. CNS

-Infections

8. BONES and JOINTS

-Septic Arthritis

-Osteomyelitis

-Rheumatoid Arthritis

9. ANEMIA

10. AUTOIMMUNE DISEASES

PRACTICALS

INSTRUMENT TEST

- RBC Pipette
- WBC Pipette
- Sahli's Pipette
- Wintrobe's PCV tube
- Hb Estimation
- Blood grouping

SPECIMEN

- Chronic Pyelonephritis
- RCC
- SCC – Foot
- Leiomyoma – Fibroid uterus
- Gall stones
- Appendicitis
- Liver abscess

MICROBIOLOGY - II

UNIT I

Virology: Introduction to virology, List of medically important viruses and diseases (AIDS, Hepatitis, Rabies, Polio) and Lab diagnosis of viral infections

UNIT II

Mycology: Introduction to Mycology, List of medically important fungi and diseases (Candidiasis, Cryptococcosis, Dermatophytes, Aspergillosis and Mucor mycosis) and Lab diagnosis of fungal infections.

UNIT III

Parasitology: Introduction to Parasitology, List of medically important parasites and diseases (E.histolytica, Plasmodium, W.bancrofti, Ascaris,Ancylostoma) and Lab diagnosis of parasitic infections

UNIT IV

Applied Microbiology-Collection and transport of clinical specimen, Sexually transmitted disease, Hospital acquired infection, Urinary tract infection, Skin and Soft tissue infection, Anaerobic infection, Respiratory tract infection and Bloodstream infection, Immunoprophylaxis, Biomedical Waste Management and standard precautions.

PRACTICALS

I. SPOTTERS

1. Ascaris lumbricoides
2. Taenia
3. Gram stained smears showing Candida
4. Universal container
5. Vaccine-OPV
6. BCG
7. Hepatitis
8. DPT
9. TT
10. MMR
11. Virology –Embryonated egg
12. Tissue culture
13. Rhabdovirus
14. Polio virus
15. HIV

II. Clinical case discussion with charts

1. Skin and soft tissue infections
2. Ring worm/ Tinea infections
3. Food poisoning
4. Gastroenteritis

RECOMMENDED BOOK:

1. Dr.C.P.Baveja- Microbiology in Nutshell (Arya Publications).

REFERENCE BOOKS:

1. Ananthanaryanan and Paniker's - Textbook of Microbiology.
2. Dr.C.P.Baveja – Textbook of Microbiology.

PRACTICAL BOOK:

1. Patwardhan,Bhat,Satish Patwardhan – Handbook of Practical examination in Microbiology.

ONLINE REFERENCES:

1. www.microrao.com
2. www.slideshare.net

PHARMACOLOGY

OBJECTIVES:

- To understand the terminologies and basic principles of pharmacokinetic and pharmacodynamic involved in the use of drugs.
- To understand the pharmacological action and mechanism of action of common drugs used for different disease conditions.
- To know the therapeutic uses and adverse effects of common drugs used for different disease conditions

INTRODUCTION:

General pharmacological principles-Definition-Routes of drug administration-Pharmacokinetics-

UNIT I:

- Pharmacodynamics-Adverse drug effects
- Drugs acting on Autonomic Nervous System, Peripheral Nervous System and Drugs acting on Central Nervous system

UNIT II

- General considerations-Cholinergic system & drugs-Anticholinergic drugs-Adrenergic drugs-antiadrenergic drugs-Drugs acting on autonomic ganglia.

UNIT III:

- Skeletal muscle relaxants-Local anaesthetics,General anaesthetics-Ethyl & Methyl alcohol-Sedatives-Hypnotics-Antiepileptics-Antiparkinsonian drugs-Drugs used in mental illness-Opioid analgesics and Non opioid Analgesics-Nonsteroidal Antiinflammatory drugs

UNIT IV

- Cardiovascular drugs , Drugs affecting Blood & Blood formation and Drugs on Respiratory system
- Cardiac glycosides,Antiarrhythmic drugs, Antianginal drugs,Antihypertensives and Diuretics,Haematinics,Erythropoietin,,Drugs affecting-coagulation,Fibrinolytic and Antiplatelet drugs,Treatment of cough and antiasthmatic drugs.

UNIT V

- Antimicrobial drugs
- General consideration-Antibiotics-Antibacterial agents-Antitubercular drugs-Antifungal-Antileprotic-Antiviral-Antimalarial-Antiamoebic-Antiprotozoal drugs-Cancer Chemotherapy,Antiseptic-Disinfectant-others.

UNIT VI

- Hormones & related Drugs, Drugs used in Gastrointestinal diseases & Miscellaneous drugs
- Corticosteroids, Anti thyroid drugs and Drugs for Diabetes Mellitus, Treatment of Vomiting, Constipation, Diarrhoea and Treatment of peptic ulcer
- Vitamins, Vaccines, Sera and chelating agents.

Recommended books:

Prep Manual for Undergraduates in Pharmacology by Tara V Shanbag, 2nd edition
Pharmacology for Dental and Allied Health Sciences by Padmaja Udaykumar, 3rd edition

Reference books:

Essentials of Medical Pharmacology by KD Tripathi, 7th edition
Basic and Clinical Pharmacology by Bertram G Katzung, 12th edition

Pharmacology (Practical)

Learning Objective

This module is intended to discuss the various modalities of drug delivery and instruments relevant to it.

Instruments

Needles	Intravenous Intrathecal Spinal Intra arterial
Students Discussion	Syringes: Tuberculin
Insulin	
I.V cannula	
Scalp. Vein set	
Students Discussion	Enema can Inhalers
Spacers	
Nebulizers	
Students Discussion	Tablets – Enteric coated, Sustained release, Sub-lingual
Students Discussion	Capsules, Spansules, Pessary, Suppository
Students Discussion	Topical Preparation, Ointment, Lotion, Powder, Drops – eye / ear
Charts: Mechanism of action of drugs, adverse effects, toxicology	
Spotters: drugs	

Text books suggested for reading:

- Text book of pharmacology for Dental & Allied Health Science 2rd edition Padmaja Udaykumar
- Pharmacology for dental students Tara V shanbhag, Smita Shenoy, Veena Nayak
- Principles of pharmacology 2rd edition H.L.Sharma & KK Sharma

MEDICAL PHYSICS

UNIT 1: Basic Concepts

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

UNIT 2: Electromagnetic Induction

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

UNIT 3: Laser

Nature of light-Reflection-Refraction-Total internal reflection- Optical fibers- Applications in Medicine - Laser-Principles-Action-Types of laser, Basic principles of laser in Medical application - Argon-Iron laser photo coagulator-Photo thermal-Photochemical application - Applications of laser in Medicine- Laser hazards and safety measures.

UNIT 4: Radiation Physics

Introduction to nuclear physics and radioactivity, Radioactive radiations - X-ray, production of x-ray, Properties of x-ray radiations - Biological effects of radiation, Radiation damage in matter, Radiation protection principles, radiation detection and measurement - Ultrasound and generation of ultrasound.

UNIT 5: Introduction to Imaging Technique

Principles of Microscope: Simple microscope and compound microscope - Radiography: Making an X-ray image –Fluoroscopy-. CT Scans, MRI - Ultrasonography: Ultrasound picture of Body-A-Scan-B-Scan-M-Scan-Ultrasound diathermy-Phonocardiography - Radio isotopes: Uses of radio isotopes -^{99m}Tc Generator- Scintillation detectors - Application of scintillation detectors - Gamma Camera - Positron Camera.

UNIT 6: Semiconductor Devices

Principles of diodes and Transistors – Integrated circuits – Amplifiers – Basic configuration and types – differential and operational amplifiers– Waveform generators – Timer – A/D and D/A converters – Active filters – Transducers – Basic configuration and types.

UNIT 7: Bio potential Recording Systems

Introduction to bioelectric potential – Electrodes and surfaces – Biopotential amplifier – Frequency ranges of various Bio potential signals – Working principles of bio potential recording systems – Electrocardiography – Electroencephalography – Electromyography.

COMPUTER SCIENCE

1. History of computers,

- Definition of computers,
- Input devices,
- Output devices,
- Storage devices,
- Types of memory,
- And units of measurement,
- Range of computers,
- Generations of computers,
- Characteristics of computers

2. System:

- Hardware,
- Software,
- system definition,
- Fundamentals of Networking,
- Internet,
- Performing searches and working with search engines,
- types of software and its applications

3. Office application suite –

- Word processor,
- spreadsheet,
- presentations,
- other utility tools,
- Fundamentals of Linux / Windows operating system, functions, interfaces, basic commands, working with the shell and other standard utilities.

4. Language

- Comparison chart of conventional language,
- programming languages,
- generations of programming languages,
- Compilers and interpreters,
- Universal programming constructs based on SDLC,
- Variable, constant, identifiers, functions, procedures, if while, do – while,
- For and other Structures.

5. Programming in C language,

- Data types, identifiers, functions and its types, arrays, union, structures and pointers
- Introduction to object oriented programming with C++: classes, objects, inheritance
- Polymorphism and encapsulation. Introduction to databases, and query languages,
- Introduction to Bioinformatics

Practicals:

1. Various browsers, search engines, email
2. Text document with images with multiple formatting options using a specified office package
3. Spreadsheet using a specified office package
4. Presentation on a specified topic using the specified locations
5. Shell programming-parameters
6. Shell program- regular expressions
7. C program- functions
8. C program – file handling
9. C program demonstrating the usage of user defined variables
10. Databases
11. Applications in Optometry

Reference Books:

1. C Programming Tutorial (K & R version 4) Author(s): Mark Burgess
2. An introduction to GCC by Brian J.Gough, foreword by Richard M.Stallman
3. Red Hat Linux 9 bible by Christopher Negus May 2003
4. Microsoft office 2003 by Jennifer Ackerman Kettell, Guy Hart-Davis

SEMESTER III

S. no	SUBJECTS
1	ANATOMY, PHYSIOLOGY, PATHOLOGY AND PHARMACOLOGY RELATED TO RADIOLOGY– THEORY (UE)
2	ANATOMY, PHYSIOLOGY, PATHOLOGY AND PHARMACOLOGY RELATED TO RADIOLOGY– PRACTICAL (UE)
3	RADIOLOGICAL PHYSICS AND DARK ROOM TECHNIQUES – THEORY (UE)
4	RADIOLOGICAL PHYSICS AND DARK ROOM TECHNIQUES – PRACTICAL (UE)
5	MEDICAL ETHICS
6	PSYCOLOGY

SEMESTER-III

ANATOMY, PHYSIOLOGY, PATHOLOGY AND PHARMACOLOGY RELATED TO RADIOLOGY– THEORY (UE)

OBJECTIVES:

- Expected to have basic knowledge on human anatomy, physiology, pathology and pharmacology.
- To develop exhaustive ideology of various pathological and Pharmacological aspects in relation to radiology

Specific Learning Outcome (SLO):

- Will be able to explain anatomy of various organs with better knowledge on terminologies.
- Will be able to explain to physiological processes with understanding during an emergency and trauma.
- Will be able to provide better support during radiological examinations with knowledge of pharmacological aspects.

UNIT –I

Introduction and general considerations

- General-Topographical and other general terms employed,
- Cell structure and function, Tissues- differentiation
- Bone structure, development and ossification;
- Skin- Elementary account of structure and physiology of the skin with special reference to the effects of Radiation
- Ductless Glands-Surface
- Markings, thyroid gland and parathyroid, suprarenal glands, pituitary gland, thymus gland and pineal body;
- Pathology in Relation to Radiographic Applications / General Pathological Terms- Inflammation – pyrexia, ulcer, bacteria and the specific granulomata neoplasms benign, malignant, with some examples, Common pathological terms related to all systems;
- Lymphatic System - Surface markings, tonsils, elementary physiology of the Lymphatic system.

UNIT-II

Musculoskeletal System

- Osseous System - Detailed description of bones and joints of the upper limb, shoulder girdle, lower limb, pelvic girdle, vertebral column, thorax, skull and their radiographic Appearance. Skull with reference to nasal bones, sinuses, temporal bone & teeth;
- The Muscular System - Voluntary and involuntary muscles with special attention to the following - Sternocleidomastoids, pectoralis major, diaphragm, iliopsoas deltoid, supraspinatus, biceps, triceps, brachialis, quadriceps femoris, erector spinae.

UNIT-III

Cardio-respiratory, Alimentary and Urinary Systems

- The Cardiovascular System - Structure and function of heart and main vessels. Their principal relations
- Composition of blood. Radiographic appearances of heart and aorta in various projections;
- The Respiratory System - Structure, position and function of nose, pharynx, larynx, trachea, bronchi, lungs and pleura with surface markings, anatomy and significance of the mediastinum;
- Elementary Physiology of Respiration - Radiographic appearance of the larynx, pharynx and trachea of the chest in various projections;
- The Alimentary System - position and function of the buccal cavity, tongue, salivary glands, pharynx, esophagus, stomach, small intestine, large intestine, liver, gall bladder and pancreas. Radiographic surface markings;
- The Urinary System - Structure, position and function of kidney, ureters, bladder and urethra, Radiographic surface markings.

UNIT-IV

Nervous System ,Reproductive System and Elementary Pathology

- The Nervous System - Spinal cord, meninges, secretion and circulation of the CSF. Radiographic appearance of the central nervous system following use of contrast media;
- Reproductive System - The uterus and tubes as shown by the injection of opaque media, Anatomy of male reproductive system;
- Elementary Pathology of Common Conditions - Benign tumors, malignant tumors, epithelial tumors, connective tissue tumors, nervous tissue tumors, tumors of the Haemopoietic and reticulo-endothelial System, leukemia.

UNIT-V

Contrast Media and Patient Care

- Contrast Pharmacology - Types of contrast media. Ionic and non-ionic contrast media, Testing of sensitivity administration of proper dose, Advantages of non-ionic contrast media, Mild to major reactions and management of the same; Patient Care in Radiology Department - Care and comfort of the patient,
- Handling of patient – fracture cases lifting of injured patients; Records of patients - Temperature, pulse and needles
- Higginson's syringe – catheters, tourniquets etc) treatment of shock – surgical – electrical, first aid for such occurrences as fainting, vomiting, epilepsy, etc, common medical and surgical terms. Psychological approach to patient as an individual not as a case in relation to pathological condition – handling of fracture cases – stretcher and bed patient – method of dealing with helpless patients – ventilation and temperature of x-ray room and cross infection, general hygiene – organization to avoid delay – waiting and rest rooms – special apparatus for children.

Text Books:

1. Human Anatomy , B.D.Chaurasia, Vol 1, 2, 3, Sixth edition, CBS Publishers & Distributors, 2013
2. Textbook of physiology, A.K.Jain, Fifth edition, Avichal Publishing Company , 2014
3. Text book of pathology, Harsh Mohan, Second Edition, Jaypee Brothers Publishers, 2013

Reference Books:

2. Human Anatomy , B.D.Chaurasia, Vol 1, 2, 3, Sixth edition, CBS Publishers & Distributors, 2013
3. Textbook of physiology, A.K.Jain, Fifth edition, Avichal Publishing Company , 2014
4. Essentials of medical pharmacology, Tripathi, 7th edition, Jaypee Brothers Medical Publishers, 2013

ANATOMY, PHYSIOLOGY, PATHOLOGY AND PHARMACOLOGY RELATED TO RADIOLOGY

PRACTICALS(UE)

CONTENTS

- Radiological surface anatomy
- Contrast agents
- Spotters
- Skeletal anatomy
- Film discussion
- Charts

Specific Learning outcomes (SLO):

- Will be able to express anatomical terminologies with clarity.
- Will be able to recognize improper physiological functions.
- Will gain competency in handling patients for Radiological examinations with knowledge on Pharmacological aspects.

RADIOLOGICAL PHYSICS AND DARK ROOM TECHNIQUES – THEORY (UE)

OBJECTIVES

- *Expected to have basic knowledge on Medical Physics and Electronics.*
- *To provide an introduction to concepts in radiation physics, radiation instrumentation, radiation safety*
- *To elaborate on operations of radiation detectors and radiographic film processing.*

Specific Learning Outcome (SLO):

- Gain knowledge on radiations and their interactions with matter.
- Gain knowledge on radiation safety and dose levels.
- Gain expertise on the dark room techniques and films for conventional radiography

UNIT-I

Radiation Physics X-Rays

- Electromagnetic radiations, waves and quanta, rectilinear propagation, inverse square law, general electromagnetic, spectrum, production and properties of X-rays; X-ray
- Spectrum: characteristic radiation and bremsstrahlung radiation. Effects of variations in the
- Tube potentials.

UNIT-IV

X – Rays Measurements

- Methods of measuring x-rays ionization measurement – realization of line roentgen parallel plate chamber. Principles of integrating, direct reading and condenser dosimeters half value layer Pocket dosimeter, chemical dosimetry,
- Scintillation detectors, solid state detectors, Film dosimetry, TLD, GM counter ionization chamber, proportional counter.

UNIT-V

Dark Room Techniques

Ideal dark room-construction-accessories-safelight, wet bench, dry bench, types of films, types of hangers, Automatic film processor-analysis the various parts of the unit maintenance, required chemicals and monitoring, Manual film processing-contents of developer and fixer-need of water bath, rinsing and various methods of drying, Types of films, manufacture of films, storage of films, film definition-density and contrast, characteristic curve, image defects, artifacts, film cassettes types of intensifying screens, Artifacts in Radiography.

Text Books:

1. X-ray Equipments for Radiographers, D. Noreen Chesney, Muriel O. Chesney, CBS publishers & distributors, third edition, 2005
2. Christensen's Physics of Diagnostic radiology, Thomas Curry, 4th edition, Lippincott Williams & Wilkins, 1990

Reference Books:

3. First Year Physics for Radiographers – George Hay, 2nd edition, Baillière Tindall, 1978.
4. Equipment in Diagnostic Radiology, E. Forster, Springer science and Business media, 2012.
5. X-ray Equipments for Radiographers, Noreen Chesney & Muriel Chesney, 3rd edition, Blackwell Scientific Publications, 1984.

**RADIOLOGICAL PHYSICS AND DARK ROOM
TECHNIQUES – PRACTICAL (UE)**

CONTENTS

- Radiation survey
- Leakage radiation test
- Manual Film Processing
- Automatic film processing
- Effect of temperature on film processing
- Effect of pH on film processing

Specific learning outcomes (SLO):

- Will be able to perform various radiation surveys.

- Will be able to demonstrate competency in interpretation image artefacts.
- Will be able to recognize variations in images based on the effect of parameters involved in film processing

PSYCHOLOGY

UNIT 1: Basic Concepts of Psychology

Definition of Psychology, Origin of Psychology - Philosophical roots of psychology, Schools of Psychology –Structuralism – Gestalt – Functionalism – Behaviorism - Psychoanalysis – Humanistic. Fields of Psychology - Work of a psychologist – Applications of psychology.

UNIT 2: Learning principles and methods

Definition of learning, Factors In The Process of Learning Classical conditioning - Operant Conditioning – The principle of reinforcement and Punishment. Theory of learning. Cognitive learning- Latent learning, Insight learning, and Imitation.

UNIT 3: Motivation, Emotion, Memory and forgetting

Motivation - Definition of motivation – Theories of motivation - Physiological basis of motivation – Motivational factors in aggression – Self-actualization motivation. Emotion – Emotional expression –Theories of emotions. Kinds of remembering – Retrieval processes – The nature of forgetting – Two process theories of memory – Improving memory –Language and thought – Symbols and concepts – Structure – Forms of thought - Thinking and reasoning –

Concept formation.

UNIT 4: Development, Sensory Processes and Perception.

Erikson's stages of psychosocial development Lawrence Kohlberg's stages of moral development Freud's Stages of Psychosexual Development Physiological basis of behavior – The brain and nervous system –The sensory process , Some general characteristic of senses – Five senses ,Perception: Organization – The role of learning in perception – Perception and attention – Perceptual process.

UNIT 5: Intelligence & Personality

Theories of intelligence – Measuring Intelligence – Kinds of intelligence tests – Ability – Formation of aptitude and attitude – Aptitude tests –Creativity and its tests. Personality – Definition of Personality – Theories of Personality – Assessment of Personality. Social Factors Influencing Personality.

UNIT 6: Social Psychology

Definition, Nature, Subject Matter and Scope Of Social Psychology-Applications and Importance of Social Psychology, Groups: Definition and Type- Primary And Secondary Groups Social Interaction, Social and Inter-Personal Relations. Inter-personal attraction – Love and Companionship. Prosocial-behavior. Modes of empathy: self – other differentiation and development of empathy. Social influence: attitude and conformity. Definition - Characteristics and Classification of Crowd. Leadership: Definition and characteristics, Defense Mechanisms, frustration and conflict, sources of frustration and conflict, types of conflicts. Aggression and Types of aggression.

UNIT 7: Health Psychology

Definition of Health Psychology -Relating Health Psychology to other fields Clinical Health Psychology, Public Health Psychology, Community Health Psychology, Critical Health Psychology

Abnormal Psychology: Concepts of normality and abnormality, causation of mental illness, neuroses, psychoses, psychosomatic disorders, measures to promote mental health.

Stress - Definitions- Models of Stress – Theories of Stress - Stress reactions – Coping and Stress

Management techniques, Pain and its management - Psychological reactions of a patient to loss – Stages of Acceptance by Kubler-Ross.

REFERENCES:

1. Clifford T. Morgan, Richard a. King, John R. Weis and John Schopler, “**Introduction to Psychology**” – **7th Edition**. Tata McGraw Hill Book Co. New Delhi, 1993.
2. Baron, R. A., & Byrne, D (2006), “**Social psychology**”, New Delhi: Prentice hall of India private limited.
3. Elliot Aronson, Timothy D. Wilson, Robin M. Akert, Samuel R. Sommers, “**Social psychology**” **9th edition** published by Pearson education, Inc., 2006
4. Shelley E. Taylor. “**Health Psychology**” **Third Edition**. McGraw Hill International Editions, 1995.
5. Swaminathan, V.D, Latha Sathish, “**Psychology for Effective Living**”, Department of Psychology, University of Madras.
6. Coleman, James. 1980. “**Abnormal Psychology and modern life**”. New Delhi: Tata McGraw Hill Ltd.

MEDICAL ETHICS AND BIO SAFETY

UNIT-I

Definition and key Concepts; philosophical considerations; epistemology of science; ethical terms; principles and theories; relevance to health care; ethics and the law issues: genetic engineering, stem cells, cloning, medical techniques, trans-humanism, bio-weapons.

UNIT-II

Define negligence, malpractice & liability; iatrogenic harm; Influence of ethics in general practice; Describe primary and secondary ethical principles; Hippocrates’ oath; Professional codes of ethics; Describe the moral basis of informed consent and advance directives; research ethics – animal rights, ethics of human cloning, and stem cell research; ICMR guidelines.

UNIT-III

Genetic testing, genetic screening, Fertility and birth control, sex determination and sex selection, Reproductive control: assisted reproduction and ethics, pre-natal genetic counseling, pre-implantation genetic diagnosis, Ethical issues in applied medicine; Workers compensation.

UNIT-IV

Euthanasia and physician-assisted dying; end-of-life care; Physicians, patients and other: autonomy, truth telling & confidentiality; emerging issues: impact of medical advances on society; Use of genetic evidence in civil and criminal court cases; Challenges to public policy – to regulate or not to regulate; improving public understanding to correct misconceptions.

UNIT-V

Introduction to Biosafety; biological safety cabinets; containment of biohazard; precautions for medical workers; precautions in patient care; Biosafety levels of microorganisms; mitigation of antibiotic resistance; radiological safety; measurement of radiation; guidelines for limiting radiation exposure; maximum reasonable dose; precautions against contamination; Institutional Biosafety committee.

SEMESTER IV

S.No	SUBJECT
1	RADIOLOGY EQUIPMENTS – THEORY(UE)
2	RADIOLOGY EQUIPMENTS – PRACTICAL(UE)
3	POSITIONING RADIOGRAPHY AND CONTRAST PROCEDURESTHEORY (UE)

4	POSITIONING RADIOGRAPHY AND CONTRAST PROCEDURES PRACTICAL (UE)
5	BASICS AND ADVANCED LIFE SUPPORT
6	MEDICAL SOCIOLOGY

SEMESTER IV

RADIOLOGY EQUIPMENTS – THEORY(UE)

OBJECTIVES:

- Expected to have basic knowledge on medical physics and electronics
- To develop in depth knowledge on radiological physics
- To develop exhaustive ideology of instrumentation and controls involved in radiology equipment

UNIT-I

Radiological Physics, Apparatus

Introduction to general properties of radiation and matter. Fundamentals of nuclear physics and radioactivity, production of x-rays, Film characteristics, Contrast, Artefacts in radiography, Interaction of x-rays and gamma rays with matter and their effects on irradiated materials.

Interaction of x-rays with patients, radiation protection, Quality assurance, Miniature radiography, macro radiography and magnification techniques; Distribution of electric power; Mains-compensators-stabilizers-single phase-three phase mobile supply cable capacity, voltage drop-main switches, fuses earthing-effects of frequency Variations

UNIT-II

Transformers, Control of output

Construction-closed or open-core-voltage and power relations, functions of core-losses and regulations copper losses, iron losses-hysteresis and inherent regulations. Types of transformers high insulation transformers-condenser effect; Resistance control of primary transformer control of primary (acute transformer) dual control-continuous central

UNIT-III

HT General Circuits and Distribution, X-ray Tubes

Valve and metal rectifiers-mechanical rectifiers-self-suppression
types of generators radiographic half- phases condenser-therapeutic-
pulsating, HT distribution-bus bars stress shield chokes,

UNIT-V

Instruments and Controls, Accessories

Milliammeters – milliampere - second meter-kilovolt meters-direct and pre reading layout of control desk contractor automatic and interlocked controls-exposure switches
(clock work electronics, synchronous electric photoelectric). Mammography, Digital

radiography, OPG, craniostat, Mobile X-ray, X-ray equipment for operation theaters, Dual energy X-ray absorptiometry; Moving grids, stationary grids curved and flat grids- focused and non-focused grids. Bucky tables, stands and pedestals, screening stands, serial devices, diaphragms, cones and applicators

UNIT-IV

Fluoroscopy

Basic principle-assembly image intensifiers-camera-filters, magnification DSA-the angiographic room-the generators-the X-ray tube-image intensifier-cine camera and associated optics-the television chain-cine film selection-processing and viewing digital fluoroscopy-Radiation safety.

Text Books:

1. X-ray Equipments for Radiographers, D. Noreen Chesney, Muriel O. Chesney, CBS publishers & distributors, third edition, 2005
2. Christensen's Physics of Diagnostic radiology, Thomas Curry, 4th edition, Lippincott Williams & Wilkins, 1990

Reference Books:

3. First Year Physics for Radiographers – George Hay, 2nd edition, Baillière Tindall, 1978.
4. Equipment in Diagnostic Radiology, E. Forster, Springer science and Business media, 2012.

X-ray Equipments for Radiographers, Noreen Chesney & Muriel Chesney, 3rd edition, Blackwell Scientific Publications, 1984.

Specific Learning Outcome (SLO):

- Will be able to explain first aid techniques for various emergency conditions.
- Will be able to explain triage during an emergency outcome.
- Will be able to provide better support during a lifesaving condition with knowledge on life support and resuscitation.

RADIOLOGY EQUIPMENTS - PRACTICAL (UE)

CONTENTS

- Testing X-ray beam and light beam alignment.
- Magnification techniques with constant SID
- Magnification Techniques with constant OID
- Beam Alignment Test
- Focal shot test
- Grid alignment test
- Chart/ Spotters

outcomes (SLO):

- Will be able to gain hands on training on life support techniques.
- Will be able to recognize Triage levels during an emergency outcome.
- Will be able to show competency in handling emergency and trauma patients with knowledge on first aid and resuscitation methods.

OBJECTIVES:

- Expected to have basic knowledge on anatomy, physiology, and pathology.
- To develop understanding of various positioning methods for imaging a structure.
- To introduce the importance of positioning and procedures involved in Radiology.

**POSITIONING RADIOGRAPHY AND CONTRAST
PROCEDURES THEORY (UE)**

UNIT-I

Practice on the patient

Age, subject types and sex, anatomical landmarks-postural variations-erect and horizontal technique- respiratory movement and diaphragm level-regional densities-preparations-and immobilization of patient- pathological conditions-injuries, fractures and dislocations congenital, localized views-periodic examinations-use of dry bones-positioning terminology identification systems; The position of the patient, the relative position of the tube to the patient and to all the exposure factors.

UNIT-II

Upper limb, Lower limb and Pelvic Girdle

Techniques for hand-fingers-thumb-wrist joint-forearm-elbow joint-humerus - shoulder joint and sterno- clavicular joint; Techniques for foot-calcaneum-ankle joint-leg-knee

joint-patella-and femur (lower two thirds); Techniques for pelvic-iliac fossa-ischium and sacro iliac joint.

UNIT-III

Vertebral column, Bones of Thorax and skull

Techniques for Atlanto-occipital articulation, cervical vertebrae, cervico-thoracic thoracic junction, vertebrae, lumbar vertebrae, lumbosacral articulation, sacrum, coccyx; Techniques for sternum, ribs (upper and lower); Techniques for cranium, facial bones, sella turcica, temporal Bone and optic foraminae sinuses, mandible and temporo mandible joint.

UNIT-IV

Abdomen

Routine and radiographs on acute condition; Bedside radiography-techniques for acute chest conditions- intestinal obstruction, abdominal perforations-vertebral injuries-skull injuries-fractures immobilized. Theatre radiography-introduction to C-arm image intensifier-exposure and training.

UNIT-V

CONTRAST PROCEDURE

Barium swallow-Barium meal series-Barium enema-double contrast barium enema, small bowel enema, double and single contrast, ERCP, PTBD, sonograms, fistulograms, mammograms, IVU, retrograde pyelogram, MCU, AUG, Opposing Urethrogram. Sialogram, dacocystogram, HSG, T-Tube cholangiogram, operative cholangiogram (on table in theatre), Radiographic image processing.

Text Books:

1. Clark's Positioning in Radiography, A. Stewart Whitley, Charles Sloane, Graham Hoadley, Adrian D. Moore, 12th edition, CRC Press, 2010.
2. Diagnostic Radiography, Glenda Bryan, 4th edition, SPCK Publishing, 1991.

Reference Books:

1. Clark's Positioning in Radiography, A. Stewart Whitley, Charles Sloane, Graham Hoadley, Adrian D. Moore, 12th edition, CRC Press, 2010.
2. Diagnostic Radiography, Glenda Bryan, 4th edition, SPCK Publishing, 1991.

Specific Learning Outcome (SLO):

- Learn the basics and principles of radiographic techniques and positioning of the patients.

- Learn the consequences of specific procedures adopted during radiographic examinations
- Learn about different procedures/indications/contraindications for various radiographic examinations

POSITIONING RADIOGRAPHY AND CONTRAST PROCEDURES – PRACTICAL (UE)

OBJECTIVES:

Expected to have basic knowledge on anatomy, physiology and pathology.

1. To inculcate knowledge on various radiographic anatomy based on disease conditions.
 2. To elaborate on various procedures and positioning involved in radiologic imaging.
-
1. Contrast procedures
 2. Film Criticism

3. Handling patient
4. Pre-medication and post-medication
5. Crash cart
6. Spotters / Chart
7. Radiographic materials

Specific Learning Outcomes (SLO):

- Develop practical skills of positioning the patient for various procedures in radiology.
- Demonstrate competency to identify and explain the anatomical structures from radiographs.
- Will be able to identify and utilize equipment during an emergency or trauma.
- Will be able to demonstrate competency in anaphylaxis management in support to a physician.

BASIC AND ADVANCED LIFE SUPPORT

- BLS
- TRIAGE
- Primary survey
- Secondary survey
- Airway & Ventilatory management
- Shock
- Central & peripheral venous access
- Thoracic trauma – Tension pneumothorax

- Other thoracic injuries
- Abdominal trauma – Blunt injuries
- Abdominal trauma – Penetrating injuries
- Spine and spinal cord trauma
- Head trauma
- Musculoskeletal trauma
- Electrical injuries
- Thermal burns
- Cold injury
- Pediatric trauma
- Trauma in pregnant women
- Workshop BLS
- Workshop cervical spine immobilization
- Imaging studies in trauma
- The universal algorithm for adult ECC
- Ventricular fibrillation/Pulseless ventricular tachycardia algorithm
- Pulseless electrical activity (PEA) / asystole algorithm
- Bradycardia treatment algorithm
- Tachycardia Treatment algorithm
- Hypotension / Shock
- Acute myocardial infarction
- Pediatrics Advanced life support
- Defibrillation
- Drugs used in ACLS
- Emergency cardiac pacing
- AED

Techniques for oxygenation and ventilation

MEDICAL SOCIOLOGY

UNIT 1: NATURE AND SCOPE OF SOCIOLOGY

Definition, Historical background, subject matter of sociology, Nature and scope, Importance, Sociology of India, Relationship of sociology with other social sciences

UNIT 2: FUNDAMENTAL CONCEPTS OF SOCIOLOGY

Society and Individual, Community, Social structure and functions of Institutions, Association, Organization, Social system, social order, Social control, social groups, Social Process, Social

change,

UNIT 3: CLASSICAL THINKERS AND THEIR CONTRIBUTIONS

Auguste comte, Emile Durkheim, Karl Marx, Max Weber, Herbert Spencer

UNIT 4: SOCIOLOGY OF INDIA

Characteristics of Indian society, Racial linguistic, Religious and demographic, Hindu social organization-ashramas, varnas, dharma and karma, purushartha, Caste system, Problems of SC&ST, Sanskritisation, Westernization and Modernization,

UNIT 5: ANTHROPOLOGY AND CULTURAL ANTHROPOLOGY

Definition of anthropology, Subfield of anthropology, Cultural Anthropology yesterday and today, Anthropological Perspectives, Early Anthropologist

Environment and culture, Kinship, Clan Ethno methodology, Gender, Subsistence and Exchange, Social Organization and evolution of political system.

Reference:

1. Bottomore.T.B., Sociology: A guide to problems and Literature,1971,Random House
2. Gisbert P. Fundamentals of sociology,3rd Edition,2004,Orient Longman publications
3. Neil J.Smelser,Handbook of sociology,1988.sage publication
4. Johnson R.M,Systematic Introduction to Sociology,1960,Allied Publishers
5. Cultural Anthropology,Barbara D.Miller,2006 Pearson/Allyn and Bacon Co
6. C.N.ShankarRao., Introduction to Sociology, 2008, S.CHAND & Company Publications.
- 7.. C.N.ShankarRao., Sociology of India, S.CHAND & Company Publications

SEMESTER V

S.No	SUBJECT
1	BASIC AND ADVANCED ULTRASOUND IMAGING – THEORY(UE)

2	BASIC AND ADVANCED ULTRASOUND IMAGING – PRACTICAL(UE)
3	BASIC AND ADVANCE COMPUTED TOMOGRAPHY- THEORY(UE)
4	BASIC AND ADVANCE COMPUTED TOMOGRAPHY- PRACTICAL(UE)
5	ENVIRONMENTAL SCIENCE AND COMMUNITY MEDICINE

SEMESTER-V

BASIC AND ADVANCED ULTRASOUND IMAGING – THEORY (UE)

OBJECTIVES:

Expected to have basic knowledge on human anatomy , physiology and Basic Positioning in radiography

- To develop in depth knowledge on physics involved in Ultrasound imaging.
- To develop exhaustive ideology of various advanced techniques for ultrasound imaging.

UNIT-I

Ultrasound physics: Ultrasound units, Transducer techniques for imaging different Anatomic areas, Different types of Transducer, Ultrasound artifacts.

UNIT-II

Ultrasound anatomy, Patient Preparation, Biologic effects and safety, Contrast agents in Ultrasound Quantities ultrasound densitometry.

UNIT-III

Doppler physics-Doppler artifacts-doppler techniques-tissue harmonic imaging, seascape imaging-Hybrid Imaging-Thermography

UNIT-IV

3D and 4D Ultrasound Imaging, patient preparation for Doppler, Vascular sonography

UNIT-V

Musculoskeletal sonography, basic echocardiography, interventional sonography, intra-operative sonography.

Text Books:

1. Diagnostic Ultrasound, Carol M. Rumack, 4th edition, Elsevier/Mosby, 2011.
2. Clinical Doppler Ultrasound Paul L. Allan, 3rd edition, Elsevier Health Sciences, 2013.

Reference Books:

1. Diagnostic Ultrasound, Carol M. Rumack, 4th edition, Elsevier/Mosby, 2011.
2. Clinical Doppler Ultrasound Paul L. Allan, 3rd edition, Elsevier Health Sciences, 2013.

Specific Learning Outcome (SLO):

- Learn the basics of ultrasound, principles, tools and accessories and advancements in ultrasound techniques and imaging
- Learn the advanced techniques used for ultrasound imaging of various organs.
- Acquire knowledge on troubleshooting of the ultrasound imaging equipment.

BASIC AND ADVANCED ULTRASOUND
IMAGING PRACTICAL (UE)

OBJECTIVES:

Expected to have basic knowledge on anatomy, pathology and basic physics of ultrasound imaging

- To inculcate knowledge on various ultrasound imaging techniques.
- To elaborate on Advanced Ultrasound imaging techniques.

CONTENTS:

- USG abdominal imaging.
- USG Neck imaging
- Doppler evaluation
- Advanced Ultrasound Imaging
- Spotter / Image discussion

Specific Learning Outcome (SLO):

- Learn various skills in ultrasound imaging techniques
- Acquire competency in handling patients for Doppler studies.
- Learn the importance of quality assurance and troubleshooting Ultrasound equipment

BASIC AND ADVANCED COMPUTED TOMOGRAPHY
THEORY (UE)

OBJECTIVES:

Expected to have basic knowledge on human anatomy, physiology and basic positioning in radiography.

- To inculcate knowledge on Physics and instrumentation of CT.
- To elaborate on various procedures and protocols in CT imaging.

UNIT-I

- Basic principle of CT scan, Generation of CT, Image formation in CT, Image quality, Hounsfield
- Detectors used in CT, X-ray tube.
- Patient preparation, Imaging techniques for Head, Chest, Abdomen and other parts

UNIT-II

- Contrast media in CT scan, Artifacts in CT, Image documentation, Safety regulation

UNIT-III

- Basics of spiral CT scan, advantages of spiral CT scan, Electron beam CT, patient preparation-CT (aortogram, selective angiogram head, neck and peripheral angiography).

UNIT-IV

- 3D processing and reconstruction-Different Rendering mode used in 3D Reconstruction-HRCT-image documentation-image filing-documental maintenance.

Text Books:

1. Computed Tomography: Physical Principles, Clinical Applications, and Quality Control, Euclid Seeram, 4th edition, Elsevier Health Sciences, 2015

Reference Books:

2. Computed Tomography - Essentials of medical imaging series, Stewart C. Bushong, illustrated edition, McGraw Hill Professional, 2000

Specific Learning Outcome (SLO):

- Learn the physics and instrumentation involved in CT imaging.
- Acquire competency in handling patients for various CT imaging studies.
- Gain knowledge of advanced techniques in CT imaging.

**BASIC AND ADVANCED COMPUTED TOMOGRAPHY –
PRACTICAL (UE)**

OBJECTIVES:

Expected to have basic knowledge on anatomy, pathology and

Positioning.

- To inculcate knowledge on basic CT imaging protocols and parameters involved.
 - To elaborate on the CT imaging techniques and protocols to diagnose various diseases.
1. Brain scanning Protocol
 2. CT Chest scanning Protocol
 3. CT Abdomen scanning Protocol
 4. CT Angiography Protocol
 5. Image processing in workstation
 6. CT Biopsy Protocol

Specific Learning Outcome (SLO):

- Learn instrumentation, physics and handling of the CT equipment.
- Demonstrate competency in handling patients in various CT imaging protocols.
- Learn to support in diagnosis based on post processing the CT images.

ENVIRONMENTAL SCIENCE AND COMMUNITY MEDICINE

UNIT-I

Natural Resources: Introduction, Multi-disciplinary nature of environmental studies,

Earth Resources and Man, Renewable And Non-Renewable Resources, Water Resources, Mineral Resources: Food Resources: Effects of modern agriculture, Fertilizer/ pesticide problems, Water logging, and salinity, Energy Resources.

Ecosystems: Concept of an Ecosystem, Structure And Functions of an Ecosystem, Producers, Consumers and Decomposers, Cycles in The Ecosystem

Pollution: Definition, Causes, Effects and Control Measures of Air Pollution, Water Pollution, Pollution, Marine Pollution, Noise Pollution, Thermal Pollution, Nuclear hazards, Solid Waste Management role of Individuals in Pollution Prevention.

Social Issues Human, Population and Environment: From Unsustainable To Sustainable Development, Urban Problems Related To Energy, Water Conservation, Rain Water Harvesting, global warming, acid rain, ozone layer depletion, nuclear accidents and nuclear holocaust.

Concept of health & disease: Concept of health, Definition of health, Philosophy of health- Dimension of health - Concept of well being, Spectrum of health, Responsibility of health - Determinates of health & Indicators of health - Concepts of disease & Concepts of cessation – Natural history of disease – Iceberg phenomenon-concept of control- concept of prevention-Modes of Intervention, Changing pattern of disease.

Epidemiology: Definition & Explanation, Aims, Epidemiologic approach, Basic measurement in epidemiology & tools of measurement – of Mortality , Epidemiologic methods – Descriptive epidemiology – Analytical epidemiology -Cohort study – Experimental epidemiology – RCT-

Association & Causation Uses of epidemiology (Criteria for judging causality) – Infection disease epidemiology Definitions Dynamic of disease transmission & Mode of Transmission – Disinfection – Definitions Types Agents used Recommended disinfection procedures – Investigation of an epidemic.

Environmental & health: Definition & Components (environment sanitation environmental sanitation) Water: Safe & Whole some water Requirements Uses source of water supply (sanitary well) – Purification (1). Large scale purification, (2). Small scale purification – Water quality – Special treatment of water Air: Composition the air of occupied room discomfort. Air pollution & its effects. Prevention & Control of air pollution Ventilation: Definition Standards of ventilation Types of Ventilation. Light, Noise & Radiation, Meteorological environment, Housing, Disposal of waste Excreta disposal

SEMESTER VI

S.no	SUBJECT
1	BASICS AND ADVANCED MRI - THEORY(UE)
2	BASICS AND ADVANCED MRI - PRACTICAL(UE)
3	INTERVENTIONAL RADIOLOGICAL PROCEDURES AND BASIC ANGIOGRAPHY – THEORY (UE)
4	INTERVENTIONAL RADIOLOGICAL PROCEDURES AND BASIC ANGIOGRAPHY – PRACTICAL(UE)
5	HEALTHCARE AND BASIC PRINCIPLES

SEMESTER-VI

BASICS AND ADVANCED MRI - THEORY (UE)

OBJECTIVES:

Expected to have basic knowledge on human anatomy , physiology and Basic Positioning in radiography

- To inculcate knowledge on Physics and instrumentation of MRI.
- To elaborate on various procedures and protocols in MR imaging.

UNIT-I

Basic principle and concepts of MRI, the need for MRI, Role of hydrogen in MR Imaging
Advantages and disadvantages of MRI,

UNIT-II

MRI architecture, magnet system and gradient system

UNIT-III

Patient screening before scanning, safety aspects

UNIT-IV

Types of magnets and RF coils, different types of pulse sequence, Fourier transformation, Inverse Fourier transformation, and K space imaging Image formation in MRI with & without gating image formation in MRI, maintaining image quality

UNIT-V

MR Angiography, (dynamic contrast MR angiography, phase contrast and TOF) Functional MRI, MR Spectroscopy, Recent advances in MRI and open MRI.

Text Books:

1.MRI in Practice, Catherine Westbrook, Carolyn Kaut Roth, John Talbot,
4th edition, John Wiley & Sons, 2011.

Reference Books:

2.Magnetic Resonance Imaging, Volume 1, David D. Stark, William G. Bradley, 3rd edition,
Mosby, 1999.

Specific Learning Outcome (SLO):

- Learn in detail about MRI physics and instrumentation.
- Demonstrate competency in handling patients for various MR imaging studies at an advanced level.
- Acquire research ideas in MR imaging with knowledge of advanced techniques in MR imaging.

OBJECTIVES:

Expected to have basic knowledge on anatomy, pathology and positioning.

1. To inculcate knowledge on Physics of MR imaging systems.
To elaborate on the MR imaging techniques and protocols to diagnose various
2. diseases.
 - MRI Brain screening Protocol demonstration
 - MRI Spine screening Protocol
 - MRI Angiography Protocol
 - MRI Musculoskeletal screening Protocol
 - Image processing in work station.
 - MR Advanced imaging Protocol

Specific Learning Outcome (SLO):

- Learn to identify the MRI equipment structure, physics and handling.
- Demonstrate the competency in handling patients in various MRI imaging protocols.
- Learn to support in diagnosis based on MRI imaging protocols.

INTERVENTIONAL RADIOLOGICAL PROCEDURES AND BASIC ANGIOGRAPHY – THEORY (UE)

OBJECTIVES:

Expected to have basic knowledge on Radiological anatomy, physiology and Basic Positioning in radiography

- To introduce the importance of Patient care and responsibilities of Technologist in Healthcare industry.
- To introduce various interventional radiology techniques and protocols.

UNIT-I

Procedure of image guided biopsies and drainage procedure

UNIT-II

Invasive Angiography and Venography, 4 Vessel DSA, Aortogram, Selective Angiogram, Venogram

UNIT-III

Invasive Monitoring, Cardiac resuscitation measures, Plethysmography, Interventional Procedures, PTBD, Stenting, Management of shock, PTA + Stenting, stent graft, Embolisation Tips, drainage procedure.

UNIT-IV

Embolisation, GDC, Glue embolisation, Vertebroplasty, Direct puncture, Laser guided procedures, Adult and Pediatric Invasive Cardiology.

UNIT-V

Basics of cardiac catheterization, Coronary angiogram, Cardiac interventional procedures

Reference Books:

- Interventional Radiology: A Practical Guide Radcliffe Series, Anthony F. Watkinson, Andy Adam, illustrated edition,
- Radcliffe Publishing, 1996

Specific Learning Outcome (SLO):

- Learn to handle patients with care and responsibilities.
- Develop competency and support radiologist in various interventional radiology protocols.

Acquire knowledge in assurance of quality in cathlab with basic knowledge of various safety considerations and quality assurance test

**INTERVENTIONAL RADIOLOGICAL PROCEDURES AND
BASIC ANGIOGRAPHY – PRACTICAL (UE)**

OBJECTIVES:

Expected to have basic knowledge on Radiological anatomy, physiology and Basic Positioning in radiography

- To introduce the importance of Patient care and responsibilities of Technologist in Healthcare industry
- To introduce various interventional radiology techniques and protocols.
 - Catheter Intervention Procedures Protocol
 - Equipment handling
 - Image guided interventional procedure Protocol
 - Image processing in work station

Specific Learning Outcome (SLO):

- Learn to handle patients with care and responsibilities in a cathlab.
- Demonstrate competency in supporting radiologists in various interventional radiology techniques.
- Learn to express support in diagnosis and treatment based on interventional radiology protocols.

HEALTH CARE MANAGEMENT

1. Concept of Health Care and Health Policy

- Health in Medical Care

- Indigenous systems of Health Care & their relevance
- Framework for Health Policy Development

2. Health Organization

- Historical development of Health Care System in the third world & India
- Organization & Structure of Health Administration in India
- Type of Health Organization including International Organizations
- Private & Voluntary Health care provider
- Distribution of Health Care Services
- Health Care System in Public Sector Organization
- Health systems of Various Countries

3. Health Policy and National Health Programme

- National Health Policy
- Drug Policy
- National Health Programs (Malaria, T.B., Blindness, AIDS etc.)
- Evaluation of Health Programs (Developing indicators for evaluation)
- Medical Education & Health Manpower Development

4. Health Economics

Fundamentals of Economics

- Scope & Coverage
- Demand for Health Services
- Health as an Investment
- Population, health of Economic Development

5. Methods & Techniques of Economic Evaluation of Health Program

- Cost Benefit & Cost Effective Methods

6. Household & Health

Health Expenditure & Outcome

- Rationale for Government action
- Household capacity, income and schooling

7. Economics of Health

- Population based health services
- Economics of Communicable and Non Communicable diseases

8. Health Insurance

SEMESTER VII

S.no	SUBJECT
1	PROJECT AND DISSERTATION
2	STATISTICS AND RESEARCH METHODOLOGY

SEMESTER-VII
BIO-MEDICAL STATISTICS AND RESEARCH METHODOLOGY

1. What is statistics – Importance of statistics in behavioral sciences – Descriptive statistics and inferential statistics – Usefulness of quantification in behavioral sciences.
2. Measurements – Scales of measurements – Nominal, Ordinal, Interval and Ratio scales.
3. Data collection – Classification of data – Class intervals – Continuous and discrete measurements – Drawing frequency polygon – types of frequency polygon – Histogram.
4. Cumulative frequency curve – Ogives – Drawing inference from graph.
5. Measures of central tendency – Need – types: Mean, Median, Mode – Working out these measures with illustrations.
6. Measures of variability – Need – Types: Range, Quartile deviation, Average deviation, Standard deviation, Variance – Interpretation.
7. Normal distribution – General properties of normal distribution – Theory of probability – Illustration of normal distribution – area under the normal probability curve.
8. Variants from the normal distribution – skewness – Quantitative measurement of skewness – kurtosis – measurement of kurtosis – factors contributing for non-normal distribution.
9. Correlation – historical contribution – meaning of correlation – types: Product, moment, content correlation, variation of product, movement correlation, rank correlation, Regression analysis.
10. Tests of significance- need for – significance of the mean – sampling error – significance of differences between means – interpretation of probability levels – small samples – large samples.

SEMESTER – VII (FOR ALL SPECIALITIES)

Project/ Dissertation

SEMESTER – VIII (FOR ALL SPECIALITIES)

Internship -6 months

