GANDHI INSTITUTE OF TECHNOLOGY AND MANAGEMENT (GITAM)

(Deemed to be University)

VISAKHAPATNAM | HYDERABAD | BENGALURU

Accredited by NAAC with A^{++} Grade

Regulations and Syllabusof

B.Sc. RADIOLOGY AND IMAGING TECHNOLOGY

(W.e.f. 2024-2025 admitted batch)

B.Sc. RADIOLOGY AND IMAGING TECHNOLOGY

(Effective from 2024-25 Admitted batch)

ADMISSIONS

Admissions into B.Sc. Paramedical (Specialization in Radiology and Imaging Technology) program of GITAM (Deemed to be University) are governed by GITAM (Deemed to be University) admission regulations.

ELIGIBILITY CRITERIA

Eligibility:

- He/She has passed the Higher Secondary (10+2) or equivalent examination recognized by any Indian University or a duly constituted Board with pass marks (50%) in Physics, Chemistry, Biology.
- He/She has attained the age of 17 years as on current year & maximum age limit is 30 years.
- For the candidates who have studied abroad, the rules of GITAM (deemed to be University) will be followed.

ABOUT THE COURSE:

Our popular Medical Science program B.Sc. Radiology and Imaging Technology lasts for 4 years and prepares students to diagnose and treat various illnesses and disorders utilizing X-rays. The candidate should have a sharp eye for detail, excellent research abilities, the ability to analyses technical data, and the ability to utilize radiography equipment with the highest accuracy if they want to develop a successful career in radiology and radiography and candidates may become ready for that by doing a B. Sc. Radiology and Imaging Technology programme.

COURSE ADMINISTRATION

- The course is delivered in 8semesters with each semester dealing with prescribed subjects.
- All subjects are mandatory for the student. The student is trained in both theory and practical/clinical aspects of the course. Student is assessed by formative and summative assessment every semester.
- There will be on internal exam before the semester –end exam. Candidates should score
- A minimum of 35% marks theory and practical internal assessment examination separately to be eligible to appear in the University exam in that subject.

A candidate shall be declared to have passed in the concerned subject, if he fulfills the
Following criteria

- He/ She secured 35% marks in the internal assessment and
- He/ She secured 40%marks in theory and
- 50% marks in practical & viva and
- 50% marks in theory, practical &viva put together in each subject separately. Course objectives and learning outcomes are specified leading to clarity on what a student would be able to do at the end of

the program.

STRUCTURE OF THE PROGRAM

The Program consists of

- Foundation Course (FC)
- Core course (C)

Each academic year consists of two semesters. The curriculum structure of the BSc Paramedical program and the contents for various courses offered are recommended by the Board of Studies concerned and approved by the Academic Council.

MEDIUM OF INSTRUCTION

The medium of instruction (including examinations and project reports) shall be English. The method of instruction shall comprise classroom lectures, guest lectures, demonstrations, presentations, role-playgroup discussions, seminars, class tests, case analysis, situational analysis, practical training etc.

ATTENDANCE REQUIREMENTS

- A candidate must have not less than 75% attendance in theory and 80% in practicals separately.

ELIGIBILITY TO APPEAR FOR SEMESTER EXAMINATION

- Candidates should score a minimum of 40% marks theory and practical internal assessment examination separately to be eligible to appear in the University exam in that subject.
- There will be one internal exam before the semester- end exam.
- Internal marks will be considered for eligibility for the semester exam but will not be added for the semester exam.

EXAMINATION DURATION AND PATTERN

a. Pattern of question paper (60 Marks): 2 ½ hrs duration

Short notes	**6Marks each (5Q)**	**=**	**30Marks**
Very Short Notes	**2Marks each (10Q)**	**=**	**20Marks**
MCQs	**1Mark each (10Q)**	**=**	**10 Marks**

Subjects:

- Biochemistry
- Microbiology
- Pathology
- General Surgery
- Principles of Laboratory management (For B.Sc. MLT)
- Parent Depts.

b. Pattern of question paper (40 Marks) : 2 hrs duration

Short notes	**4Marks each (5Q)**	**=**	**20Marks**
Very Short Notes	**2Marks each (10Q)**	**=**	**20 Marks**

Subjects:

- Introduction to Healthcare Delivery System, Research Methodology & Biostatistics
- Introduction to Quality and patient safety
- Basic Computers and Information Science
- English, Communication and soft skills
- Professionalism & Values
- Principles of management (For B.Sc. Anesthesiology Technology, Optometry, Radiology and Imaging Technology, Renal Dialysis Technology, Emergency Medical Technology)
- Medical Law & Ethics
- Pharmacology
- General Medicine

c. Pattern of question paper (60 Marks [30 + 30]): 2 ½ hrs duration.

Short notes	**3Marks each (5Q)**	**=**	**15 Marks**
Very Short Notes	**2Marks each (5Q)**	**=**	**10 Marks**
MCQs	**1Mark each (5Q)**	**=**	**05 Marks**

Subjects:

Anatomy-I (Part-A) & Physiology-I (Part-B)

Anatomy-II (Part-A) & Physiology-II (Part-B)

PAPER SETTING

Paper setting, paper valuation and practical examination is done by internal examiners from the I to VI semesters.

CRITERIA FOR EXAMINER

- Professor or Associate Professor or Assistant Professor are eligible to be as examiners.

GRACE MARKS: Maximum 5 marks can be awarded to one subject provided he/she passed all the other subjects or these 5 marks can be split for maximum 2 subjects.

PASS CRITERIA

A candidate shall be declared to have passed the examination if he/ she secured…

(a) 40% marks in theory.
(b) 50% marks in practical & viva
(c) 50% marks in theory, practical & viva put together in each subject separately.

EVALUATION:

Single valuation is done for the theory exams and for the practical exams.

REVALUATION:

Revaluation of the theory answer scripts of the end-semester examinations is also permitted on request, on payment of the prescribed fee within seven days from the date of announcement of the results.

REAPPEARANCE FOR BACKLOGS :

A student who has secured 'F' grade shall have to reappear for the examination as per the regulations to improve the grade.

A student who has secured 'F' grade in Project work / Industrial Training etc., has to re-appear for Viva – Voce to improve the grade.

ANSWER SCRIPT VERIFICATION & CHALLENGE VALUATION:

A provision for Answer Book Verification & Challenge Valuation was given on the following conditions.

- The verification is allowed only after announcement of revaluation results in case of UG programs.
- If the student is not satisfied with the marks awarded in revaluation, he/she can apply for Answer Book verification on payment of prescribed fee for each paper (Program) within one week after announcement of Revaluation results.
- If the student is not satisfied with the marks awarded after Answer Script Verification (i.e. Revaluation marks), he/she can apply for Challenge Valuation on payment of prescribed fee for each paper (Program) within two weeks from the date of Answer Book Verification.

ASSESSMENT GUIDELINES

RELATIVE GRADING

S.No.	Grade	Description	Grade Formula	Grades based on percentile for a normal distribution	Grade Point
1.	O	Outstanding	Total Marks≥(μ+ 1.5σ)	93.3	10
2.	A+	Excellent	(μ+ 1.0σ)≤Total Marks<(μ+1.5 σ)	84.1	9
3.	A	Very Good	(μ+0.5 σ)≤ Total Marks<(μ+ 1.0 σ)	69.1	8
4.	B+	Good	(μ-0.5σ) ≤Total Marks<(μ+0.5σ)	30.8	7
5.	B	Above Average	(μ- 1.0 σ) ≤Total Marks<(μ- 0.5σ)	15.8	6
6.	C	Average	(μ- 1.5σ)≤Total Marks<(μ-1.0σ)	6.6	5
7.	P	Pass	40≤Total Marks<(μ- 1.5 σ)	2.2	4
8.	F	Fail	Total Marks <40	0	0
9.	Ab	Absent			NA
10.	S	Satisfactory for Non-graded courses			NA
11.	U	Unsatisfactory for Non-graded courses			NA
12.	R	Insufficient attendance in the course			0
13.	W	Withdrawal from the course			0

In the relative grading system (RG), grades are given based on the other students' scores in the same class. It

indicates the academic standing/merit of the student in that class. Here, class means a cohort of students who are taught by the same faculty member and have undergone the same assessment pattern. RG overcomes problems encountered with AG, including inconsistency in the level of the question paper and evaluation etc. This evaluation procedure is adopted for T (Theory), TP (Theory and practical) and certain chosen practical courses. The grades and grade points in the relative grading system are as given below. The class average mark (μ) is taken as the midpoint of 'B+ (Good)' grade, and relative to this and depending on the sigma (σ, standard deviation) value, the other grades are finalized. Grades are assigned based on the percentiles determined for a normal distribution given in the table below.

Computing Grade point averages (SGPA,CGPA)

The procedure adopted for computing the grade point average for the semester and cumulative is as follows:
Semester Grade point average(SGPA)for a semester is calculated as:

$$\text{SGPA} = \frac{\sum_{i=1}^{n} Ci * Gi}{\sum_{i=1}^{n} Ci}$$

where 'n' is the number of courses taken by the student in a semester. 'Ci' represents the number of credits allotted to the course 'i'.
'Gi' represents the grade points secured by the student in course 'i'.

Cumulative Grade Point Average (CGPA):It is calculated as:

$$\text{CGPA} = \frac{\sum_{i=1}^{m} Ci * Gi}{\sum_{i=1}^{m} Ci}$$

where 'm' is the number of courses graded to date.
'Ci' represents the number of credits allotted to the course 'i'.
'Gi' represents the grade points secured by the student in course 'i'.

The SGPA will be awarded to the students for all the registered courses in a semester. The credits of the failed courses shall also be considered while calculating SGPA/CGPA in a given semester. For cases where multiple attempts have been made to get a letter grade, the last successful attempt will be used for the CGPA calculation.

The additional credits earned by a student over and above the minimum required for a said category in a program will not be considered for the calculation of CGPA. However the courses which contribute towards higher CGPA will be considered for inclusion.

Calculation of CGPA

The CGPA shall be calculated taking into consideration the grades of courses obtained by the candidates in GITAM. In the case of Study Abroad, Twinning, Joint or Dual Degree Programs, the CGPA will be calculated according to the respective policy applicable and prevailing at the time of joining the program.

Incomplete (I) Grade

'I' grade is assigned if the student has any pending assessment components in Internship, Project and research. The student can initiate the request through the Mentor, and an 'I' grade will be posted after receiving the recommendation from the HoD.

Repeat (R) grade

'R' grade is assigned if the student has to repeat the course due to a shortage of attendance. The student has to re-register for the course in the subsequent semesters when the course is next offered by paying the prescribed fees.

Withdrawal (W) grade

'W' grade is assigned if the student has withdrawn from the course within twenty (20) working days of the semester.

Award of class

The cumulative grade point requirement for the award of the class is as follows:

Class	CGPA required
First-class with distinction	7.5 and above
First-class	6.00 - 7.49
Second class	≥ 5.5
Pass class	≥ 5.0

*In addition to the required CGPA of 8.0 or more, the student must have necessarily passed all the registered courses in the first attempt. Distinction will not be awarded if the student fails in ANY subject.

Transcript Format

Based on the above recommendation on letter grades, grade points, SPGA and CGPA, the transcript shall be issued for each semester with a consolidated transcript indicating the performance in all semesters.

VISION:

To become a leader of excellence in healthcare and health professions' education pioneering in experiential learning, redefining compassion, service and self-reliance to produce and nurture the next generation of visionary healthcare professionals

MISSION:

1. Develop a need-oriented learning ecosystem promoting critical thinking and holistic development
2. Offer evidence-based healthcare training at par with global standards
3. Encourage autonomy and innovation for healthcare delivery to achieve atma-nirbhar
4. Inculcate a philosophy of empathetic healthcare service within GITAM, fostering passionate health professionals

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

PEO 1	To impart knowledge and skill in accordance with the requirement in basic medical sciences and paramedical specialty as relevant
PEO 2	To impart training required to carry out necessary investigative procedures accurately to facilitate proper diagnosis and prognosis of diseases
PEO 3	To train the student to perform routine as well as special investigative procedures in the concerned paramedical specialty
PEO 4	To impart knowledge and practical training required to operate and maintain all equipment used in the concerned specialization
PEO 5	To impart knowledge about communication skills, basic research skills, professionalism, and ethical aspects required in various health care settings for effective delivery of health care

PROGRAMME OUTCOMES (POs)

PO1	To prepare a cadre of healthcare technologists who can effectively assist senior health professionals in the delivery of quality healthservices.
PO2	To prepare skilled paramedical human resources for all levels of the healthcare delivery system from primary to tertiary care level.
PO3	To train the students to carry out necessary procedures accurately and to facilitate proper diagnosis and prognosis of diseases.
PO4	To enable to perform routine as well as special investigative procedures in the concerned paramedical specialty.
PO5	To develop knowledge and skill in accordance with the demand in the field of paramedical specialty as applicable.
PO6	To enable to operate and maintain all types of equipment used in the concerned specialization.
PO7	To make capable to support advanced testing activities and Research.
PO8	To enable to work as Supervisor/Trainer/Teacher in the field of Paramedical sciences.
PO9	To enable to communicate and interact effectively with non-clinical and clinical persons in various healthcare environments
PO10	To be able to present oneself in an ethical and professional manner
PO11	To equip the paramedical staff with modern skills and knowledge to bring them at par with other national and international standards
PO12	Students who complete these programs will be able to work in both an individual and team environment

PROGRAM SPECIFIC OUTCOMES (PSOs)

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

PSO1	To be able to demonstrate quality patient care skills including Professionalism, patient consent and ethical behaviors as specified in the code of ethics.
PSO2	To be able to undertake X-RAY, Mammography, CT scan and MRI Procedures independently.
PSO3	Assist in specialized radiological procedures.
PSO4	To be able to do the image processing and evaluation for technical quality.
PSO5	To be able to handle, take care and maintenance of all radiological and Imaging equipment independently.
PSO6	Should ensure radiation protection and quality assurance.
PSO7	Able to identify and manage emergency situations.
PSO8	Able to receive and document verbal, written and electronic orders in the Patient's medical record.

SUBJECTS FOR SEMESTER EXAMS WITH HOURS AND CREDITS

Semester - I									
SI. No.	**Subject Code**	**Subject**	**Hours**			**Credits**			**Course Type**
			Theory	Practical	Total	Theory	Practical	Total	
1	24CMED1001	Introduction to Healthcare Delivery System in India, Community orientation and clinical visit, Research Methodology & Biostatistics	15	-	15	1	-	1	FC
2	24PSGY1001	Anatomy-I (Part-A)	30	15	45	2	0.5	2.5	C
		Physiology-I (Part-B)	45	15	60	3	0.5	3.5	C
3	24MIBG1001	Introduction to Quality and patient safety (including Basic emergency care and life support skills, Infection prevention and control, Biomedical waste management, Disaster management and Antibiotic resistance)	60	60	120	4	-	4	FC
4	24CSEN1071	Basic Computers and Information Science	15	30	45	1	-	1	FC
5	LANG1281	English, Communication and soft skills	30	-	30	2	-	2	FC
6	24CMED1011	Professionalism & Values	15	-	15	1	-	1	FC
7	ODHR1001	Principles of Management	15	-	15	1	-	1	FC
		Total	**225**	**120**	**345**	**15**	**1**	**16**	

Semester - II									
SI. No.	**Subject Code**	**Subject**	**Hours**			**Credits**			**Course Type**
			Theory	Practical	Total	Theory	Practical	Total	
1	24PSGY2001	Anatomy-II (Part-A)	30	15	45	2	0.5	2.5	C
		Physiology – II (Part-B)	45	15	60	3	0.5	3.5	C
2	24FMED1001	Medical Law and Ethics	15	0	15	1	0	1	FC

3	24RADG1001	Radiological Physics with Conventional Radiography and equipment	75	225	300	5	7.5	12.5	C
4	24RADG1011	Clinical Posting – I		120	120				
		Total	**165**	**375**	**540**	**11**	**8.5**	**19.5**	

Semester - III

SI. No.	**Subject Code**	**Subject**	**Hours**			**Credits**			**Course Type**
			Theory	Practical	Total	Theory	Practical	Total	
1	24NURS1001	Basics of Patient Care	30		30	2		2	FC
2	24MIBG1031	Microbiology	60	15	75	4	0.5	4.5	C
3	24PATH1031	Pathology	60	15	75	4	0.5	4.5	C
4	24RADG2001	Modern Radiological & Imaging Equipment	60	180	240	4	6	10	C
5	24RADG2011	Clinical Posting – II		120	120		4	4	C
		Total	**210**	**330**	**540**	**14**	**11**	**25**	

Semester - IV

SI. No.	**Subject Code**	**Subject**	**Hours**			**Credits**			**Course Type**
			Theory	Practical	Total	Theory	Practical	Total	
1	24RADG2021	Ultrasound Physics	30	75	105	2	2.5	4.5	C
2	24RADG2031	Clinical Radiography with Special Radiography Procedures	60	210	270	4	7	11	C
3	24RADG2041	Clinical Posting – III		165	165		5.5	5.5	
Total			**90**	**450**	**540**	**6**	**15**	**21**	

Semester - V

SI. No.	**Subject Code**	**Subject**	**Hours**			**Credits**			**Course Type**
			Theory	Practical	Total	Theory	Practical	Total	
1	24RADG3001	Radiographic Techniques and Physics of CT Imaging Technology	60	285	345	4	9.5	13.5	C
2	24RADG3011	Regulatory Requirements in Diagnostic Radiology & Imaging, Act and rules, regulations for JCI, NABH, NABHR.	30		30	2		2	C
3	24RADG3021	Clinical Posting - IV		165	165		5.5	5.5	
Total			**90**	**450**	**540**	**6**	**15**	**21**	

Semester - VI

SI. No.	**Subject Code**	**Subject**	**Hours**			**Credits**			**Course Type**
			Theory	Practical	Total	Theory	Practical	Total	

1	24RADG3031	Cross-sectional MR Anatomy and MR Physics	60	270	330	4	9	13	C
2	24RADG3041	Quality Control, Quality Assurance & Radiation Safety (AERB Guidelines) in Diagnostic Radiology	30		30	1		1	C
3	24RADG3051	Clinical Posting – V		180	180		6	6	
Total			**90**	**450**	**540**	**5**	**15**	**20**	

Semesters - VII & VIII

Sl. No.	**Subject Code**	**Subject**	**Hours**			**Credits**			**Course Type**
			Theory	Practical	Total	Theory	Practical	Total	
1		MRIT Internship			1440				C

SEMESTER - I

INTRODUCTION TO HEALTHCARE DELIVERY SYSTEM, RESEARCH METHODOLOGY & BIOSTATISTICS

INTRODUCTION:

The art and science of application of technical knowledge and skills to the delivery of health care to given community, designed in collaboration with related professionals as well as human and social science on one hand and the community on the other hand. Preventive medicine is science and art of preventing disease, prolonging life and promoting physical and mental health and efficacy.

COURSE OBJECTIVES:

- To orient the students with national health programs
- To learn categories and coding of hospital waste and their disposal methods.
- To know various occupational health hazards and prevention and control of them.
- To make the students aware of tabulation of data, measuring mean and SD

SYLLABUS
Hours: Theory 15
Credits: Theory 01

NO. OF UNITS	CONTENT	NO. OF HOURS
I	**Introduction to healthcare delivery system** a) Healthcare delivery system in India at primary, secondary and tertiary care, Principles and Elements of Primary Health Care b) National Health Mission c) National Health Policy 2017	3
II	**National Health Program:** Background objectives, action plan, targets, operations, achievements and constraints in various National Health Programs. **Introduction to AYUSH system of medicine and Need for integration of various systems of medicine**	3
III	**Demography & Vital Statistics:** a) Demography – its concept b) Vital events of life & its impact on demography c) Significance and recording of vital statistics d) Census & its impact on health policy	5

	Epidemiology: a. Principles of Epidemiology b. Natural History of disease c. Methods of Epidemiological Studies **d.** Infectious disease epidemiology - dynamics of disease transmission, host defence immunizing agents, cold chain, immunization, disease monitoring and surveillance.	
VI	**Research Methodology:** 1. Introduction to research methods 2. Identifying research problem 3. Ethical issues in research 4. Research design 5. Basic Concepts of Biostatistics 6. Types of Data 7. Research tools and Data collection methods 8. Sampling methods 9. Developing a research proposal	**3**
V	**Biostatistics** The objective of this is to help the students understand the basic principles of research and methods applied to draw inferences from the research findings.	**1**

COURSE OUTCOMES:

This course is aimed to make the student to understand national health programs, hospital waste management, occupational health hazards prevention and control of occupational diseases and calculation of measures of central tendency and diagrammatic representation of data.

REFERENCES:

- Park's Textbook of Preventive and Social Medicine – 26th edition
- Statistics and Research: Mahajan

ANATOMY - I

INTRODUCTION:

Anatomy deals with the structural organization of the human body. Anatomy forms the basis for the practice of medicine. Students need core knowledge of human anatomy as they venture into the clinical domain. The department of anatomy is committed to providing quality education for students by its fully-equipped facilities. Cadaveric dissections & specimens, histology slides, and VARIOUS models provide the idealenvironment to learn anatomy during the 1st year of their course.

COURSE OBJECTIVES:

- The objective of this subject is to provide an outline of anatomy to improve the students understanding of the technical and diagnostic procedures used, with special emphasis on applied aspects.

SYLLABUS

Hours: Theory: 30 & Credits: 2

Practical: 15 Credits: 0.5

Theory:

UNIT	CONTENT	No. OF HOURS
I	**Introduction to anatomical terms and organization of the human body** 1.Undertanding the anatomical terms relative to position–anterior, ventral, posterior dorsal, superior, inferior, median, lateral, proximal, distal, superficial, deep, prone, supine, palmar and plantar Anatomical planes (axial/ transverse/horizontal, sagittal/vertical plane and coronal/frontal/oblique plane) 2. Describe the Movements (flexion, extension, abduction, adduction, medial rotation, lateral rotation, inversion, eversion, supination, pronation, plantar flexion, dorsal flexion and circumduction 3. Describe the Cell structure, Cell division, 4. Define the Tissue and classify various types, characteristics, classification, location 5. Describe the location of Hyaline cartilage ,fibrocartilage, elastic cartilage, 6.Describe the Histology of Bone, 6. Describe the Features of skeletal, smooth and cardiac muscle.	5
II	The Respiratory system 1. Describe the Structure of the organs of respiration. 2. Describe the morphology of Pleura,	5

	3. Describe the Morphology of Lungs, Bronchopulmonary Segments. 4. Histology of Lungs	
III	Cardiovascular system 1. Describe the Morphology of Heart, Internal features of Heart – right atrium and right ventricle Chambers & Openings of the heart, 2. 2.Classify Types of Circulation and understand Coronary Circulation in detail 3. Describe Aorta its parts and its branches.	8
IV	Muscular system types of muscles 1. Describe Muscles of Upper Limb including Arm and Fore Arm, 2. Describe Muscles of back, diaphragm, Muscles of arm, Muscles of Forearm 3. Understand the Significance of Deltoid Muscle, 4. Describe the Muscles of Lower Limb, Muscles of thigh, Muscles of Leg 5. Understand the significance of Gluteus Maximus Muscle.	5
V	1. Describe the Blood vessels of Upper Limb : Arm- Axillary artery, brachialartery 2. Describe arteries of fore Arm - Radial artery, ulnar Artery, medial cubital vein, 3. Describe the Blood vessels of Lower Limb : Thigh femoral artery, popliteal artery	7

Practical:

NO. OF UNITS	CONTENT	NO. OF HOURS
I	Microscopy, Histology of tissues – cartilage, Bone and Lung	2
II	Intercostal space, Heart, Lungs	3
III	Upper Limb – Bones, Muscles, Axillary artery, brachial artery, fore Arm - Radial artery, ulnar Artery, medial cubital vein, Nerves : Axillaries Nerve , Median Nerve, Ulnar Nerve, radial Nerve	4
IV	Lower Limb – Bones, Muscles, Thigh femoral artery, popliteal artery Nerves of Lower Limb: Femoral Nerve, Sciatic Nerve, Obturator Nerve	4
V	Normal X- Rays, Surface markings	2

COURSE OUTCOMES:

- Explains knowledge on the basic anatomy of various regions like limbs, thoracic and abdominal viscera, osteology, neuroanatomy, endocrine system, basic radiology which provides a foundation in completion of the course.
- Explain the anatomy and functions of various Tissues and cells, an organization of a cellular system.

- Understand the functioning of lungs, heart, and blood vessels.

REFERENCES:

1. BD Chaurasia : Handbook of general anatomy
2. Textbook of Anatomy & Physiology by InduKhurana & Arushi
3. Textbook of Anatomy & Physiology by PR Ashalatha & G Deepa
4. Textbook of Anatomy & Physiology by Ashalatha N Nandedkar, Vijay D Joshi& Sadhana – 3rd edition

PHYSIOLOGY - I

INTRODUCTION

Physiology is the study of functions and mechanisms in a living system. Physiology focuses on individual organs, cells, and bio molecules carrying out the chemical and physical functions in a living system. The physiological state is the condition of normal function, while the pathological state refers to abnormal conditions, including human diseases.

COURSE OBJECTIVE

- Understand the basic physiological functions of different organs and parts of the human body and important applied aspects.

SYLLABUS

Credits: Theory 03 & Practical 0.5

Hours: Theory 45 & Practical 15

NO. OF UNITS	CONTENT	NO. OF HOURS
I	**Cell Physiology** 1. Describe the structure and functions of cell 2. Describe the functions of the cell organelles 3. Describe briefly the types of transport across cell membrane and carrier systems.	05
II	**Blood Physiology and Immunology** 1. Describe the normal composition of human blood and its functions 2. Describe the normal plasma proteins & their functions 3. Describe the structure and functions of RBC and hemoglobin 4. Describe the process of Erythropoiesis 5. Describe the Structure, production, & functions of WBCs 6. Describe the structure, production & functions of Platelets 7. Describe the Types of blood groups and their importance, 8. Describe the Mechanism of coagulation 9. Define immunity and describe the types of immunity 10. Classify antigen & antibodies 11. Describe T cell immunity & B cell immunity	12
III	**Muscle & Nerve Physiology; ANS** 1. Describe the physiological structure of muscle tissue and its types 2. Describe the parts of neuron and their functions, and the synapse and	08

	its function 3. Describe the action potential, its basis, refractory period, latent period, etc. and neuromuscular transmission 4. Describe briefly the autonomic nervous system and the functions and effects of the sympathetic and parasympathetic nervous systems	
IV	**Digestive System** 1. Describe briefly the Physiological anatomy of G.I.T and its functions. 2. Describe briefly the composition and functions of Saliva 3. Describe briefly the physiological anatomy of the stomach and the composition, functions of gastric juice. 4. Describe briefly the functions of pancreas, and the composition & functions of pancreatic juice. 5. Describe briefly the functions of liver and gall bladder and the Composition, and functions of bile juice**.**	08
V	**Respiratory System** 1. Describe the physiological structure and functions of Respiratory tract. 2. Describe the Mechanics of respiration and its regulation 3. Describe the Fundamentals of oxygen and CO2 transport in blood 4. Describe the lung volumes, spirometry & their importance	12
PRACTICAL		
NO. OF UNITS	**CONTENT**	**NO. OF HOURS**
I	Estimate Hemoglobin in given blood sample, Estimate bleeding time & clotting time	04
II	Perform RBC count of given blood sample	02
III	Perform WBC count of given blood sample Perform a differential WBC count of the given sample	04
IV	Calculation of blood indices, Determination of Blood Groups	03
V	Amphibian Nerve muscle charts	02

COURSE OUTCOMES:

- Explain the anatomy, physiology and functions of various Tissues and cell, organization of cellular system.
- Explain Hematopoietic and lymphatic system homeostatic and its altered physiology.
- Explain the anatomy and Physiology of the cardiovascular and respiratory system and its

disorders.

- Explain the anatomy and Physiology of digestive, urinary, and reproductive systems and their disorders.
- Describe the Physiology of muscle contraction and its disorders.

REFERENCES:

- Textbook of physiology for BDS AK Jain 6th edition
- Textbook of physiology for BDS Sembulingam 3rd edition
- Physiology in nutshell by AK Jain 5th edition

INTRODUCTION TO QUALITY AND PATIENT SAFETY

SYLLABUS

Theory: 60 hrs Credits 4

Practical/Clinical: 60hrs

Rationale: The subject will introduce the students to the basic concepts of quality in health care and develop skills to implement sustainable quality assurance program in the health system. It will sensitize them in basic emergency care, infection prevention & control with knowledge of bio medical waste management and antibiotic resistance.

NO. OF UNITS	CONTENT	NO. OF HOURS
I	**Quality assurance and management** 1. Concepts of Quality of Care 2. Quality Improvement Approaches 3. Standards and Norms 4. Quality Improvement Tools 5. Introduction to NABH guidelines	10
II	**Basics of emergency care and life support skills** 1. Vital signs and primary assessment 2. Basic emergency care – first aid and triage 3. Ventilations including use of bag-valve-masks (BVMs) 4. Choking, rescue breathing methods 5. One- and Two-rescuer CPR 6. Using an AED (Automated external defibrillator). 7. Managing an emergency including moving a patient	10
III	**Bio medical waste management and environment safety** 1.Definition of Biomedical Waste 2.Waste minimization 3.BMW – Segregation, collection, transportation, treatment and disposal (including color coding) 4.Liquid BMW, Radioactive waste, Metals / Chemicals / Drug waste 5.BMW Management & methods of disinfection 6.Modern Technology for handling BMW 7.Use of Personal protective equipment (PPE) 8.Monitoring & controlling of cross infection (Protective devices	8
	Infection prevention and control 1. Evidence-based infection control principles and practices [such as Sterilization, Disinfection, Effective hand hygiene and use of Personal Protective Equipment (PPE)].	12

	2. Prevention & control of common healthcare associated infections 3. Components of an effective infection control program, and 4. Guidelines (NABH and JCI) for Hospital Infection Control	
IV	**Antibiotic Resistance** 1. History of antibiotics 2. How resistance happens and spreads 3. Types of resistance- intrinsic, acquired, passive 4. Trends in drug resistance 5. Actions to fight resistance 6. Bacterial persistence 7. Antibiotic sensitivity 8. Consequences of antibiotic resistance 9. Antimicrobial Stewardship – Barriers and opportunities, tools and models in hospitals	10
V	**Disaster preparedness and management** 1. Fundamentals of emergency management 2. Psychological impact management 3. Resource management 4. Preparedness and risk reduction 5. Key response functions (including public health, logistics and governance, recovery, rehabilitation and reconstruction), information management, incident command and institutional mechanisms.	10

SUGGESTED READINGS:

1. The Essentials of Patient Safety by Charles Vincent
2. Laboratory quality control and patient safety by De Gruyter
3. Essentials of applied microbiology for nurses including infection control and safety by Apurba

PRACTICAL/ CLINICAL

No. OF UNITS	CONTENT	No. OF HOURS
I	**QUALITY AND PATIENT SAFETY** a) Discussion on Concepts of Quality of Care b) Approaches to Quality Improvement c) Quality Improvement Tools	10

	Discussion on NABH guidelines and its exercises	
II	**BASICS OF EMERGENCY CARE AND LIFE SUPPORT SKILLS** 1. Vital signs and primary assessment 2. Basic emergency care – first aid and triage 3. Ventilations including use of bag-valve-masks (BVMs) 4. Choking, rescue breathing methods 5. One- and Two-rescuer CPR 6. Using an AED (Automated external defibrillator). Managing an emergency including moving a patient Students should perform the maneuvers in simulation lab and to test their skills with focus on airways management and chest compressions.	10
III	**BIO MEDICAL WASTE MANAGEMENT AND ENVIRONMENT SAFETY** 1. Visit to Central Sterile Supply Department (CSSD) 2. Visit to incinerator complex 3. Visit to Immunization section 4. Discussion on Biomedical Waste, 5. Demonstration of Types of waste generated from Health Care Facility 6. Discussion on waste minimization 7. Poster presentation of BMW – Segregation, collection, transportation, treatment and disposal (including color coding) 8. Discussion on Liquid BMW, Radioactive waste, Metals / Chemicals / Drug waste 9. Visit to Central Sterile Supply Department for demonstration of BMW Management & methods of disinfection 10. Modern Technology for handling BMW e.g. Incinerator, Shredder etc. 11. Demonstration of proper use of Personal protective equipment (PPE) 12. Demonstration of monitoring & controlling of cross infection (Protective devices)	8
	INFECTION PREVENTION AND CONTROL 1. Demonstration of evidence-based infection control principles and practices [such as Sterilization, Disinfection, Effective hand hygiene	12

	and use of Personal Protective Equipment (PPE)], 2. Discussion on prevention & control of common healthcare associated infections, 3. Preparing Charts & Posters of Components of an effective infection control program, and 4. Guidelines (NABH and JCI) for Hospital Infection Control	
IV	**ANTIBIOTIC RESISTANCE** 1. Discussion on various types of Antibiotics 2. Demonstration of how Resistance Happens and Spreads 3. Discussion on types of resistance- Intrinsic, Acquired, Passive 4. Antibiotic sensitivity testing 5. Display of Consequences of antibiotic resistance 6. Demonstration of Antimicrobial Barriers and opportunities, Tools and models in hospitals	10
V	**DISASTER PREPAREDNESS AND MANAGEMENT** 1. Discussion on fundamentals of emergency management, 2. Management psychological impact 3. Discussion on; 3.1 Resource management, 3.2 Preparedness and risk reduction	10

BASIC COMPUTERS AND INFORMATION SCIENCE

INTRODUCTION:

Computer science spans theoretical disciplines (such as algorithms, theory of computation, and information theory) to practical disciplines (including the design and implementation of hardware and software). It deals with concepts regarding the architecture of a computer, common application software and uses of computers in everyday life.

COURSE OBJECTIVES:

To build necessary concepts regarding the architecture of a computer

To develop an understanding of the common application software.

To understand the uses of computers in everyday life.

SYLLABUS

Theory 15 hrs. & Credit 1
Practical 30hrs.

NO OF UNITS	CONTENT	NO. OF HOURS	NO. OF PRACTICAL
I	1. Describe and identify the principal components of a computer 2. Define the various terms used in computer – hardware/software / operating system 3. Describe the functions and uses of computers including in health care	2	4
II	1. Mention the common types of files including Word documents, Spreadsheets (Excel) and Presentations (PowerPoint) and their uses 2. Basic Network connecting 3. Explain the uses of the internet and email 4. Collaborative work using Google suite of applications / Microsoft Office 365	2	6
III	1. Demonstrate use of a computer for common purposes 2. Demonstrate methods for Data storage & retrieval and making folders; 3. Perform functions like date/time setting or changing, change display settings, Installing /removing programs etc. 4. Understand and Use MS Word / Word Document program 5. Prepare a properly formatted, spell-checked document in Word Document including insertion of images and tables and take a print-out/mail as an attachment, and convert to pdf (portable document format) 6. Understand and Use MS Excel / Data spreadsheet 7. Prepare a proper Excel document (spreadsheet) with given data and sort out data, insert / delete cells, etc., use formula bar for common functions like calculate mean etc, convert to pictorial format like bar / pie diagram, etc. 8. Prepare and use computer-based presentations like PowerPoint with appropriate fonts and colors including insertion of images,	5	10

	videos etc.		
IV	1. Prepare an appropriate file like excel to enter patient data and retrieve it 2. Use the facility of Mail Merge between Excel to a Word document 3. Sending customized email to selected members. 4. Prepare a patient report and take a print out	3	6
V	1. Prepare a database of patient info and lab results for storage and later retrieval 2. Communicate by e-mail including opening email account 3. Demonstrate use of search engines / Google search etc. for academic information 4. Elements of Health Information - Definition, Key Features, Comparison with traditional methods, Benefits, Emerging Trends, and Challenges	3	4

LEARNING OUTCOMES:

- At the end of the training program, the student would be able to
- Classify various components of the computer.
- Experiment with the various application software of Microsoft Office suite.
- Make use of collaborative applications over the internet

COURSE OUTCOMES:

At the end of the course student is expected to

1. Know about the concept and architecture of a computer
2. To understand the common application software.
3. To understand and apply the uses of computers in everyday life.

REFERENCES

1. Introduction to Computers by Peter Norton (McGraw Hill Education)
2. Mastering Excel: A Problem-Solving Approach by James Gips (John Wiley and Sons)
3. SAMs Teach Yourself Computer Basics in 24 hours

ENGLISH, COMMUNICATION & SOFT SKILLS

INTRODUCTION:

The course is a unified approach to enhance language skills of learners with an aim to hone their social skills and to increase their employability. The course is designed to acquaint the learners with the necessary LSRW (Listening/ Speaking / Reading/ Writing) skills It enables the learners improve their communication skills which are crucial in an academic environment as well as professional and personal lives.

COURSE OBJECTIVES

- This course trains the students in oral presentations, expository writing, logical organization and structural support.
- By acquiring skills in the use of communication techniques the students will be able to express better, grow personally and professionally, develop poise and confidence and achieve success.

SYLLABUS
Hours : 30 Credits: 02

NO. OF UNITS	CONTENT	NO. OF HOURS
I	**BASICS OF ENGLISH GRAMMAR** Vocabulary:- Synonyms , Antonyms, Prefix and suffix , Homonyms , Tenses , subject verb agreement , common errors in English.	8
II	**LISTENING AND SPEAKING SKILLS** Importance of listening and speaking. Barriers in listening and speaking. Good and persuasive listening and speaking Note Taking, Watching Video Clips and Listening to Audio Clips, Listening to and Watching News and Panel Discussions JAM (Just-A-Minute),Oral Presentation , Group Discussion	8
III	**READING AND WRITING SKILLS** Efficient and fast reading, Importance of Skimming and Scanning	4
IV	Letter Writing, Email, Essay, Paragraph writing, Articles, Memos, note making and Comprehension.	4
V	Common Medical Terminology and writing a medical report	6

COURSE OUTCOMES

- By the end of the course, the learners will be able to:
- Think critically, analytically, creatively and communicate confidently in English insocial and professional contexts with improved skills of fluency and accuracy.
- Write grammatically correct sentences employing appropriate vocabulary suitableto different contexts

- Comprehend and analyze different academic texts.
- Make notes effectively and handle academic writing tasks such as Paragraph writing and Essay writing.
- Effectively handle formal correspondence like e-mail drafting and letter writing.

REFERENCE BOOKS:

- Arosteguy, K.O. and Bright, A. and Rinard, B.J. and Poe, M. A Student's Guide toAcademic and Professional Writing in Education, UK, Teachers College Press, 2019
- Raymond Murphy, English Grammar in Use A Self-Study Reference and Practice Book for Intermediate Learners of English: Cambridge University Press;2019
- Peter Watkins, Teaching and Developing Reading Skills: UK, CUP, 2018
- Deeptha Achar et al. Basic of Academic Writing. (1and 2) parts New Delhi: OrientBlack Swan. (2012& 2013).
- Kumar S and Lata P, Communication Skills: New Delhi Oxford University Press, 2015

PROFESSIONALISM & VALUES
SYLLABUS
Hours : 15 Credits: 01

NO. OF UNITS	TOPIC	NO. OF HOURS
I	**Professional values** Integrity, Objectivity, Professional competence and due care, Confidentiality	3
II	**Personal values** E ethical or moral values	3
III	**Attitude and behavior** Professional behavior, treating people equally	2
IV	**Code of conduct** Professional accountability and responsibility, misconduct	2
V	**Differences** between professions and importance of team efforts	2
	Cultural issues in the healthcare environment	3

PRINCIPLES OF MANAGEMENT
SYLLABUS
Hours : 15 & Credits: 01

The course is intended to provide a knowledge about the basic principles of Management.

Unit	Topics	No. of Hours
I	Introduction to management Strategic Management	3
II	Foundations of Planning Planning Tools and Techniques	3
III	Decision Making, conflict and stress management Managing Change and Innovation	3
IV	Understanding Groups and Teams Leadership	3
V	Time Management Cost and efficiency	3

SEMESTER – II

ANATOMY – II

INTRODUCTION:

Anatomy deals with the structural organization of human body. Anatomy forms the basis for the practice of medicine. Students need core knowledge of human anatomy as they venture into the clinical domain. The department of anatomy is committed to provide quality education for students by its fully-equipped facilities. Cadaveric dissections & specimens, histology slides and VARIOUS models provide the ideal environment to learnanatomy during the 1st year of their course.

COURSE OBJECTIVES:

The objective of this subject is to provide an outline of anatomy to improve the students understanding the technical and diagnostic procedures used, with special emphasis on limbs, thoracic and abdominal viscera, osteology, neuro anatomy, endocrine system, basic radiology.

SYLLABUS

Hours: Theory 30 & Practical 15

Credits: Theory 02 & Practical 0.5

NO. OF UNITS	CONTENT	No. OF HOURS
I	The Nervous system Review Structure of neurons; CNS, ANS and PNS (Central, autonomic and peripheral) – Peripheral nerves , Brachial, Lumbar, Sacral plexus, Covering of brain, Surfaces and lobes of cerebrum white fibers of cerebrum, cranial nerves, brain stem, spinal cord - spinal nerves, functional areas of cerebral cortex, Ventricular system – formation, circulation, and drainage	9
II	Gastro Intestinal Tract Stomach morphology, blood supply, applied aspects Liver morphology, ligaments blood supply applied aspects, porta hepatitis Small and large intestine, appendix and appendicitis	5
III	The Excretory system & Reproductive system Morphology , relations and internal Structure of kidney, urethra Components of female reproductive system, Morphology of uterus and its supports Parts of Fallopian Tube, Layers of scrotum, Anatomy of Testis and its coverings Spermatic cord, Male urethra & its parts	7
IV	The Endocrine system Endocrine glands, Structure of Hypothalamus, Pineal Gland, Pituitary gland-Dwarfism Thyroid- Goiter, Parathyroid, Pancreas – Diabetes Mellitus, Adrenal glands, Gonads	5

V	The Sensory organs Receptors, Structure of skin, Eye - Anatomy of orbit and eyeball, Anatomy of Nose, Anatomy of ear, Anatomy of tongue	4
Practical:		
NO. OF UNITS	**CONTENT**	**No. OF HOURS**
I	Histology of Liver, Thyroid, Kidney	3
II	Liver, Stomach, Intestines	3
III	Spleen, Kidney	3
IV	Brain, Spinal card	3
V	Bony Pelvis, Skull, Normal X- Rays, Surface markings	3

COURSE OUTCOMES:

- This course is aimed to make the student to gain knowledge in basic anatomy of various regions like limbs, thoracic and abdominal viscera, osteology, neuro anatomy, endocrine system, basic radiology which provides foundation in completion of the course.
- Enable to understand about the Gastro Intestinal Tract, location, surfaces, lobes,relations, and blood supply of Liver.
- Enables to understand about the Endocrine glands and explain the morphology and blood supply of Thyroid gland.

REFERENCES:

1. Anatomy and physiology –Vijaya D Joshi, Ashalatha N Nandedkar, Sadhana S Mendhurwar
2. Anatomy and physiology- Indu Khurana and Arushi Khurana
3. Human anatomy &physiology for nursing -Mahindra KumarAnand & Meena Verma
4. Understanding human anatomy & physiology- William Davis(McGraw-Hill)

PHYSIOLOGY – II

INTRODUCTION

Physiology is the study of functions and mechanisms in a living system. Physiology focuses on individual organs, cells, and biomolecules carry out the chemical and physical functions in a living system. Physiological state is the condition of normal function and this course helps in understanding the functions of endocrine system, renal physiology and reproductive physiology.

COURSE OBJECTIVES:

- To know about functions and physiological anatomy of endocrine system – Thyroid, Adrenal, Parathyroid, Pituitary glands and Pancreas.
- To impart knowledge related to physiological structure of kidney and the nephron and its functions.
- To understand about reproductive system, process and methods of determination of ovulation.
- To know about types of joints, the structure and formation of cartilage and the structure and formation of bone.

SYLLABUS

Credits: Theory 03 & Practical 0.5

Hours: Theory 45 & Practical 15

NO. OF UNITS	CONTENT	No. OF HOURS
I	**Cardiovascular System** 1. Describe the gross structure of heart and the normal circulation of blood 2. Describe the cardiac cycle 3. Describe the normal arterial pulse wave and the normal heart rate, and factors increasing and decreasing it. 4. Describe normal Blood pressure and its regulation, 5. Describe the normal Heart sounds 6. Describe the normal ECG and its importance	**12**
II	**Endocrine Physiology** 1. Describe the physiological anatomy of Thyroid gland, functions and its applied physiology 2. Describe the physiological anatomy of Adrenal gland, functions and its applied physiology 3. Describe the physiological anatomy of Parathyroid gland, functions and its applied physiology 4. Describe the physiological anatomy of Pancreas, its functions and its applied physiology 5. Describe the physiological anatomy of hypothalamus and the Pituitary gland, their functions and its applied physiology	**10**
III	**Excretory Physiology** 1. Describe the physiological structure of kidney and the nephron and its functions 2. Describe the GFR and factors affecting GFR 3. Describe the Substances absorbed and secreted from renal tubules 4. Describe the various Renal function tests	**10**

	5. Describe briefly the Urinary bladder and its functions and the physiology of micturition **6.** Functions of skin **7.** Acid base balance	
IV	**Reproductive Physiology** 1. Describe the physiology of puberty 2. Describe the process of menstruation, normal menstrual cycle, menarche and menopause. 3. Describe briefly the process of ovulation and methods of determination of ovulation 4. Describe briefly the normal physiology of pregnancy and mention the diagnostic tests for pregnancy and their physiological basis 5. Describe briefly the functions of placenta and pregnancy diagnostic tests 6. List out the Contraceptive methods in male and female 7. Describe the Spermatogenesis	06
V	**Central Nervous System** 1. Describe the physiological anatomy of the brain and functions of different lobes 2. Describe briefly the structure and functions of spinal cord 3. Describe briefly the subdivisions of brain stem and their functions 4. Describe briefly the special senses and their pathways – vision, audition (& olfaction & taste) 5. Describe the normal EEG 6. Describe briefly the CSF formation, circulation, properties, composition and functions	07

PRACTICAL

NO. OF UNITS	CONTENT	No. OF HOURS
I	General examination – Brief history, General appearance, Vital data	02
II	Pulse and BP	03
III	Demonstrate examination of heart – inspect JVP, localize apex beat, look for any abnormal pulsations, percuss cardiac dullness, auscultate heart for normal sounds	02
IV	Demonstrate examination of respiratory system – inspect the chest for symmetry, movements, localize apical impulse and trachea, measure chest expansion, percuss the chest for lung resonance, liver dullness, auscultate lungs for breath sounds	02
V	Demonstrate examination of the cranial nerves	02
VI	Demonstrate the various sensory and motor reflexes - abdominal, plantar, biceps, triceps, supinator, knee, and ankle	02
VII	Clinical charts	02

REFERENCE BOOKS

- Human Anatomy & Physiology for Nursing – Mahindra Kumar Anand & Meena Verma Understanding Human Anatomy & Physiology – William Davis (McGraw Hill) Anatomy & Physiology – Kaarna Muni Shekhar

- Textbook of Physiology for BDS students - Dr Jain
- Textbook of Physiology for BDS students – Dr Sambulingam
- Handbook of Human Physiology – Vidya Ratan
- Concise Medical Physiology – Sujith K Choudhari

MEDICAL LAW AND ETHICS

SYLLABUS

Hours: Theory 15

Credits: Theory 01

Legal and ethical considerations are firmly believed to be an integral part of medical practice inplanning patient care. Advances in medical sciences, growing sophistication of the modern society's legal framework, increasing awareness of human rights and changing moral principles of the community at large, now result in frequent occurrences of healthcare professionals being caught in dilemmas over aspects arising from daily practice.[28]

Medical ethics has developed into a well based discipline which acts as a "bridge" between theoretical bioethics and the bedside. The goal is "to improve the quality of patient care by identifying, analyzing, and attempting to resolve the ethical problems that arise in practice".[28] Doctors are bound by, not just moral obligations, but also by laws and official regulations that form the legal framework to regulate medical practice. Hence, it is now a universal consensusthat legal and ethical considerations are inherent and inseparable parts of good medical practice across the whole spectrum. Few of the important and relevant topics that need to focus on are asfollows:

NO. OF UNITS	TOPICS	NO. OF HOURS
I	1. Medical ethics - Definition - Goal - Scope 2. Introduction to Code of conduct 3. Basic principles of medical ethics – Confidentiality	3
II	4. Malpractice and negligence - Rational and irrational drug therapy 5. Autonomy and informed consent - Right of patients 6. Care of the terminally ill- Euthanasia	3
III	7. Organ transplantation 8. Medico legal aspects of medical records – Medico legal case and type- Records and document related to MLC - ownership of medical records - Confidentiality Privilege communication - Release of medical information - Unauthorized disclosure - retention of medical records - other various aspects.	3
IV	9. Professional Indemnity insurance policy 10. Development of standardized protocol to avoid near miss or sentinel events	3
V	11. Obtaining an informed consent.	3

RADIOLOGICAL PHYSICS WITH CONVENTIONAL RADIOGRAPHY AND EQUIPMENT

INTRODUCTION:

B.Sc. Radiology & Imaging Technology meticulously structure to impart in depth advance knowledge of imaging methods and principles. The curriculum has been designed to meet the growing needs of professionals in the field of clinical radiography, imaging technology and radiation safety. Students benefit from doing the course as there is a large volume of work in all areas.

COURSE OBJECTIVES:

This course is aimed at making the student understand the principles of medical physics and radiological equipments as applicable to health care and practice them in their respective speciality. Know how to use various radiological and electronic instruments to record and interpret the overall wellbeing of the human system.

SYLLABUS

Hours: Theory 75 & Practical 225

Credits: Theory 5 & Practical 7.5

NO. OF UNITS	Topics	No. of Hours
I	**BASIC PHYSICS** Basic concepts: Units and measurements-Force, work, power and energy-Temperature and heat-SI units of above parameters. Atomic structure-atom model-Nucleus-electronic configuration-periodic table-Isotopes-Ionization-excitation-Binding energy-electron volt-Electromagnetic radiation-Quantum nature of radiation-mass energy equivalence-Fluorescence-electromagnetic spectrum. Electricity and magnetism, capacitors ohms law.	15
	SOUND 1. The nature and propagation of sound wave (the characteristics of sound, wave theory), speed of sound in a material medium, intensity of sound, the decibel, Interference of sound waves, beats, diffraction. 2. Doppler's effect, Ultrasonic wave, production of ultrasonic waves (piezo-electric effect) in ultra sonography. **3.** Use of principle of Doppler's effect in Diagnostic Radiology (e.g. Echo, blood flow measurement).	
II	**BASIC RADIOLOGICAL PHYSICS** 1. X-rays: Discovery of x-rays-X-ray production and properties: Bremsstrahlung Radiation-Characteristics X-Rays, factors affecting X-ray emission spectra, X-ray quality and quantity, HVL measurements, heel effect, soft and hard X-Rays, added and inherent filtration, reflection and transmission targets. **2. Interaction of ionizing radiation with matter**-Types of interactions of X-and gamma radiation, Photoelectric Compton, Pair production, annihilation	15

	radiation. Interaction of Xand gamma rays: Transmission through matter, law of exponential attenuation, half value layer, and linear attenuation coefficient-coherent scattering photonuclear disintegration Particle interactions. Interactions of Xrays and Gamma raysinthebody; fat-soft tissue-bone-contrastmedia-totalattenuationcoefficient-relativeclinicalimportance.Exponential attenuation (linear/mass attenuation coefficients), Half Value Thickness (HVT), Tenth Value Thickness (TVT), dependence on energy and atomic number.	
III	**X-Ray equipment & units:** 1. X-ray tube: historical aspects, construction of X-ray tubes, requirements for X-ray production(Electron source, target and anode material), tube voltage, current, space charge, early X-ray tubes(Coolidge tubes, tube envelop and housing)cathode assembly, X-ray production efficiency, advances in X-ray tubes, anode angulation and rotating tubes-line focus principle-space charge effect, tube cooling-Modern X-ray tubes-stationary anode, rotating anode, grid controlled X-ray tubes, heel effect, off focus radiation, tube insert and housing-Tube rating-Quality and intensity of x-rays-factors influencing them. 2. Grid controlled and high-speed tubes, focal spot size, speed of anode rotation, target angle, inherent filtration, radiation leakage and scattered radiation. Interlocking and X-ray tube overload protection. Heat dissipation methods, tube rating, heat units, operating conditions. 3. Filament current and voltage, X-ray circuits (primary circuit, auto transformer), types of exposure switch and timers, principle of automatic exposure control (AEC) and practical operation, filament circuit, high voltage circuits, half wave, full wave rectification, three phase circuits. Types of generators, 3 phase, 6 and 12 pulse circuits-high frequency generators-falling load generators, Capacitors discharge and grid control systems. X-ray tube: historical aspects, construction of X-ray tubes, requirements for X-ray production(Electron source, target and anode material), tube voltage, current, space charge, early X-ray tubes(Coolidge tubes, tube envelop and housing)cathode assembly, X-ray production efficiency, advances in X-ray tubes, anode angulations and rotating tubes-line focus principle-space charge effect, tube cooling-Modern X-ray tubes-stationary anode, rotating anode, grid controlled X-ray tubes, heel effect, off focus radiation, tube insert and housing-Tube rating-Quality and intensity of x-rays-factors influencing them. 4. Grid controlled and high-speed tubes, focal spot size, speed of anode rotation,	**15**

	target angle, inherent filtration, radiation leakage and scattered radiation. Inter locking and X-ray tube overload protection. Heat dissipation methods, tube rating, heat units, operating conditions. 5. Filament current and voltage, X-ray circuits (primary circuit, auto transformer), types of exposure switch and timers, principle of automatic exposure control (AEC) and practical operation, filament circuit, high voltage circuits, half wave, full wave rectification, three phase circuits. Types of generators, 3 phase, 6 and 12 pulse circuits-high frequency generators-falling load generators, Capacitors discharge and grid control systems.	
IV	**Generators**: **1.** X-ray generator circuits: Vacuum tube diodes-semi-conductor diodes-transistor-Rectification-half and full wave-self rectification-X-ray generator; filament circuit-kiloVoltagecircuit-singlephasegenerator-threephasegenerator-constantpotentialgenerator-Fuses, switches and interlocks-Exposures witching and timers-HT cables- earthing. Physical quantity, its unit and measurement: Fundamentalandderivedquantity,SIunit,variousphysical/radiationquantityusedinDiagnosticRadiologyanditsunit(forexample,KVp,mA,mAS,Heatunit(HU).	**15**
V	**Radiation Quantities and Units:** Radiation intensity-exposure, roentgen, its limitations-kerma and absorbed dose-electronic equilibrium-rad, gray, conversion factor for roentgen to rad-quality factor-dose equivalent rem, Sievert. Quality factor, dose equivalent, relationship between absorbed dose and equivalent dose.	**15**
	Conventional Radiological Equipment Production of x-rays: X-ray tube, gas filled x-ray tube, construction working and limitations; stationary anodexray tube ; construction, working, methods of cooling the anode, rating chart and cooling chart; rotating anodexray tube : construction, working rating chart,speedofanoderotation,angleofanodeinclination,dualfocusandpracticalconsiderationinchoiceoffocus,anodeheeleffect,gridcontrolledx-raytube;effectofvariation of anode voltage and filament temperature; continuous and characteristic spectrum of x - rays, inherent filter and added filter, their effect on quality of the spectrum.	

PRACTICAL		
NO. OF UNITS	**TOPICS**	**NO. OF HOURS**
I	Radiography of Upper limb	45
II	Radiography of Lower limb	45
III	X-ray beam alignment test	45
IV	Determination of magnification by changing Source to Image Distance	45
V	Determination of magnification by changing Object to Image Distance	45

COURSE OUTCOMES:

- Should be able to perform X -RAYS of upper & lower limbs independently.
- Assist in specialized radiological procedures.
- Able to do image processing.
- Should be able to identify all radiological and imaging equipment.

REFERENCE BOOKS:

1. Textbook of radiology for residents and technicians – Satish K Bhargava- 5th edition
2. Handbook of Medical Radiography latest edition by C Ram Mohan
3. Radiographic positioning Niranjan Baghel

CLINICAL POSTING - I

Hours 120

Students will gain additional skills in clinical procedures, interaction with patients and professional personnel. Students apply knowledge from previous clinical learning experience under the supervision of a senior technologist. Students are tested on intermediate clinical radio diagnosis skills.

SEMESTER – III

BASICS OF PATIENT CARE

INTRODUCTION:

This course develops knowledge and skills basic to patient care undergoing radiographic procedures. Topics include patient communication, patient assessment, and safety of patient and healthcare provider in the health care facility. Focus extends to include properbody mechanics and patient positioning to promote comforting for patient. Basics of infection control and methods of medical asepsis were focused on especially when dealingwith patients undergoing certain invasive procedures. Finally describe and perform basic procedures like injections, Ryle's tube, Foley's catheterization, taking blood samples, wound dressing etc.

COURSE OBJECTIVES:

1. Students will gain understanding of the fundamental concepts of patients care whilein the hospital or undergoing a special procedure.
2. Students will become familiar with some procedures relevant to patient condition
3. Students will Be able to provide certain basic procedures and identify symptoms ofaltered cognition.
4. Students will be able to relate them to patient overall health and well being.
5. Relationship between certain procedures, radiographic procedure, and patient overall health will be emphasized.

SYLLABUS
THEORY: 30Hr and 2 Credits

LEARNING OUTCOMES:

The main Intended Learning Outcome (ILO) that is measured throughout this course is "Critical Thinking." This ILO is conceptually defined as "a cognitive process that aims at using the rational and logical examination of ideas for the purposes of understanding, problem solving, and decision-making." Critical thinking will facilitate the process of teaching/ learning, which is originally a change in thinking or behaviour.

I- Caring

II- Communication

III- Critical thinking

IV- Therapeutic

interventionV - Leadership

V- Employer's satisfaction

NO. OF UNITS	CONTENT	NO. OF HOURS
I	**Describe the principles of careof bedridden patient** - Care of a bedridden patient - Patient assessment - Assessing personal concerns of patient - Assessing physiological needs Assessing current physical status **Describe the basicprinciples of communication** Communication with patients and attendants - Communication skills - Communication with patients - Special circumstances in communication - Patient education - Communication with patient's families Dealing with death and loss	3
II	**Describe and demonstrate techniques to maintain patient hygiene** Patient hygiene - Cycle of infection - Body's defence against infection - Infectious diseases - Maintaining hygiene **Describe and practice infection control measures in the ward and ICU** Infection control measures in the ward and ICU - Microorganisms - Cycle of infection - Hand Washing Preventing disease transmission	3
III	**Describe and record vital data and basic clinicalparameters** Vital data and basic clinical parameters -Assessment of body temperature: sites, equipments and techniques, special considerations - Assessment of pulse: Sites, location , equipments and technique, special consideration - Assessment of respirations: technique, special consideration Recording of vital signs **Describe and demonstrate howto monitor patients** Patients monitoring Assessing personal concerns of patient - Assessing physiological needs - History taking - Physical assessment	3

IV	**Describe the principles of patient safety** **-** Patient transfer - Restraints and immobilization - Accidents and incident reports - Fire hazards Other common hazards **Describe and demonstrate the principles of cleaning, disinfection and sterilization in thehospital wards/ ICU** - Hand washing: simple, hand antisepsis and surgical antisepsis (scrub) - Isolation: source and protective -Sterile packs - Surgical scrubbing - Gowning and gloving -Sterilization - Fumigation Autoclaving **Describe the common routesfor drug administration** -Assess the patient's condition - Recognize different definitions associatedwith pharmacology - Recognize various classifications of drugs - Identify the ten rights of drug administration - List out common routes and methods ofdrug administration - Perform venipuncture using appropriateuniversal Precautions	3
V	**Describe and perform basic procedures** -Injections, -Ryle's tube, -Foley's catheterization, -Taking blood samples, -Wound dressing **Describe and demonstrate documentation ofpatient related data in thecase sheet records** -History taking data sheet - Documentation: Purpose of Recording and reporting, Communication within the HealthCare Team, - Types of records; ward records, medical/nursing records, Common Record-keeping forms, Computerized documentation **Describe and demonstrate useof basic hospital equipment** Use of basic hospital equipment	3

COURSE OUTCOMES:

1. Perform basic infection control practices in the Healthcare setting.
2. Use effective skills to draw blood and accurately label tubes
3. Perform basic procedures using advanced technique and interpretation.
4. Perform basic patient care skills.

5. Communicate with a diverse patient population using written and oralcommunication and listening skills in interactions.

REFERENCES:

1. Ehrlich, R., A., McCloskey, E. D., & Daly, J., A. (2004). *Patient Care in Radiography with an Introduction to Medical Imaging.* Mosby: An Affiliate of Elsevier. Sixth edition.
2. Adler, A., M., & Carlton, R., R. (2007). *Introduction to Radiologic Sciences and Patient Care*. Saunders: Elsevier. Fourth edition
3. Torres, L.,S. (1989). *Basic Medical Techniques and Patient Care for Radiologic Technologists*. J. B.Lippincott Company: Philadelphia. Third Edition.

MICROBIOLOGY

INTRODUCTION:

The goal of teaching Microbiology is to provide understanding of the natural history of infection and diseases in order to deal with the Etiology, pathogenesis, Pathogen city, laboratory diagnosis, treatment control and prevention of these infections and infectious diseases.

COURSE OBJECTIVES:

- Plan and interpret Laboratory investigations for diagnosis of infectious diseases and correlate the clinical manifestations with the etiological agent.
- Perform simple laboratory test which help to arrive at rapid diagnosis.
- Understand methods of disinfection and sterilization and their application to
- Control and prevention of hospital acquired infections.

SYLLABUS

Credits: Theory 04 & Practical 0.5

Hours: Theory 60 & Practical 15

NO. OF UNITS	TOPICS	NO. OF HOURS
I	**General Bacteriology** Morphology • Classification of microorganisms, size, shape and structure of bacteria. • Use of microscope in the study of bacteria Growth and nutrition • Nutrition, growth and multiplication of bacteria Culture media, Culture methods & AST	4
	Immunology • Immunity & types of immunity • Antigen & Antibody • Antigen-Antibody reactions • Structure & functions of immune system • Immune response • Hypersensitivity • Autoimmunity • Vaccines & National Immunization schedule	8
	Systematic Bacteriology • Staphylococci, Streptococci, Pneumococci, Gonococci, Meningococci, C. diphtheriae, Mycobacteria, Clostridia, Bacillus, Shigella, Salmonella, E. coli, Klebsiella, Proteus, Vibrio cholerae, Pseudomonas & Spirochetes. Miscellaneous bacteria	18
II	**Sterilization and Disinfection**	2

	• Principles and use of equipment of sterilization namely hot air oven, autoclave and serum inspissator, pasteurization. • Chemical methods of sterilization (like ETO & Plasma sterilization) Disinfectants and Antiseptic agents used in the hospital.	
	Hospital Infection • HAIs- prevention and control (Standard precautions, Transmission based precautions & Bundle care).	**2**
	Principles and practice of Biomedical waste management	**1**
III	**Parasitology** Morphology, life cycle, laboratory diagnosis of following parasites: • E. histolytica • Free living amoeba • Hydatid disease • Plasmodium • Tape worms • Intestinal nematodes • Somatic nematodes	**10**
IV	**Mycology** • General Mycology • Superficial Mycoses • Subcutaneous Mycoses • Systemic Mycoses • Opportunistic fungi	**5**
V	**Virology** • General Virology • Herpes • Arbo viruses • Influenza, Parainfluenza, Corona • Hepatitis • HIV • Rabies • Poliomyelitis.	**10**

PRACTICALS		
NO. OF UNITS	**TOPICS**	**NO. OF HOURS**
I	Specimen collection and handling	2
	Microscopy & Hanging drop preparation	1
	Slide preparation and staining • Gram staining • Acid fast staining	3
	• KOH mount • Fungal culture	1
II	Serology • Rapid tests • ELISA demo	1

III	Standard precautions- • Hand hygiene	1
	PPE (donning & doffing)	1
	• Spill management • NSI (Needle stick injury)	1
	• Cough etiquette • Safe injection practices	1
IV	Sterilization & Disinfection of instruments	2
V	Biomedical waste management	1

COURSE OUTCOMES:

- Knowledge about the association of Micro-organisms in Disease and HealthRequirement and the common pathogens of Medical importance
- Know about the commonly used Microbiology Laboratory equipment and the cleaning of glassware
- Know about Collection, Transportation and processing of clinical samples for Microbiological Investigations
- Knowledge about Sterilization and Disinfection practices
- Development of skills of Media pouring
- Slide and Smear preparation
- Performing Staining techniques in Microbiology (Simple staining, Gram'sstaining, AFB staining)

REFERENCES:

- Ananthanarayan and Paniker's Textbook of Microbiology – 10th edition
- Textbook of Microbiology C P Baveja

PATHOLOGY

INTRODUCTION

The goal of teaching Pathology is to provide comprehensive knowledge of the causes and mechanisms of the duties in order to enable to achieve complete understanding of the natural history and clinical manifestation of the diseases.

COURSE OBJECTIVES:

- To describe the rationale and principles of technical procedures of diagnostic laboratorytests.
- To know about basic diagnostic tests and correlate with clinical and morphological features of diseases.
- To learn about commonly used bedside tests on blood, urine and other relevant samples.

SYLLABUS

Hours: Theory 60 & Practical 15

Credits: Theory 4 & Practical 0.5

NO. OF UNITS	CONTENT	NO. OF HOURS
I	**Cell Injury** Adaptations Necrosis Apoptosis Types, Mechanisms of cell injury	4
	Inflammation Signs, Mechanisms, chemical Mediators & outcomes of Inflammation Acute Phase reactants and Granulomatous inflammation	4
	Tissue Repair & Regeneration	1
	Hemodynamics Hyperemia, congestion, edema Thrombosis Embolism Infarction & Shock	5
	Neoplasia Differences between benign & malignant tumors, invasion & Metastasis, features of malignancy, Causes of cancer	3
	Infections TB Leprosy, syphilis HIV Malaria	6

II	**Hematology** Anemia- Definition & classification Iron Deficiency Anemia, Megaloblastic anemia, Hemolytic anemia Blood grouping Causes & definition - Leukocytosis, leucopenia, Leukemoid reaction, BT, CT, PT, APTT, thrombocytosis, thrombocytopenia, splenomegaly	6
III	**GIT- 1** Peptic ulcer, Barrett`s esophagus	1
	Hepatobiliary system Jaundice Cirrhosis-definition & causes, Viral Hepatitis – causes. Modes of transmission	2
	Endocrine Diabetes- subtypes and differences, complications and diagnosis, hypo and hyperthyroidism	2
IV	**Blood vessels** Atherosclerosis HTN –types, causes & diagnosis	2
	CVS Myocardial infarction- etiopathogenesis, Lab diagnosis Rheumatic fever	2
	Lung COPD Asthma, pneumonia	3
V	**Kidney** ARF- definition & causes, CRF- definition & causes Renal stones Classification of renal diseases, congenital abnormalities of urinary system Glomerular diseases: causes, types & pathology (Nephritic , nephrotic syndrome) Tubulointerstitial disorders- ATN, TIN, Pyelonephritis & tuberculous pyelonephritis Renal vascular disorders End stage renal disease: causes & pathology Pathology of kidney in hypertension, pregnancy & diabetes Pathology of peritoneum, peritonitis, bacterial, tubular & sclerosing peritonitis, dialysis induced changes Pathology of urinary tract infections	18
	CNS Meningitis – causes, routes of spread, CSF findings, encephalitis	1
PRACTICALS TOPICS		**NO. OF**

	HOURS
Blood Grouping	1
Peripheral smear	2
Urine examination	2
Slides	2
Specimens	3
Charts, interpretation of CBP, BT, CT, PT, APTT	4
Instruments	1

COURSE OUTCOMES:

- At the end, the students shall be able to describe the rationale and principles of technical procedures of diagnostic laboratory tests.
- Interpret diagnostic laboratory test and correlate with clinical and morphological features of diseases.
- Perform simple bedside tests on blood, urine and other biological fluid samples.

REFERENCES:

- Pathologic basis of disease – Robbins & Cotran 10th edition
- Pathology – Harshmohan 8th edition
- Textbook of Pathology for Allied Health Sciences – Ramdas Nayak
- Textbook on Pathology for DMLT and Paramedical courses – Dr. I.Clemen
- Essentials of Clinical Pathology – Shirish. M. Kawthalkar 2nd edition

MODERN RADIOLOGICAL AND IMAGING EQUIPMENT

INTRODUCTION:

This subject is to provide an outline of basic Modern Radiological Equipment including Physics, advanced x-ray equipments. This gives an outline about the contrast agents. It also helps to improve the students understanding of the technical and diagnostic equipment used with special emphasis on applied aspects.

COURSE OBJECTIVES:

- Know about X- RAY, fluoroscopy and contrast agent procedures
- To train in assisting in advanced radiological procedures.
- To know about working of Digital radiography.
- To know about the Radiographic and Image Processing Techniques

SYLLABUS

Credits: Theory 4 & Practical 6

Hours: Theory 60 & Practical 180

No. of Units	Topic	No. of Hours.
I	**High tension circuits**: H.T. generator for x-ray machines, three phase rectifier circuits, three phase six rectifier circuit, three phase 12 rectifier circuit, high and medium frequency circuits; capacitance filter control and stabilizing equipment; mains voltage compensator, mains resistance compensator, compensation for frequency variation, control of tube voltage, compensator; high tension select or switch, filament circuit, control of tube current, space charge compensation. **Control of scattered radiation**: Beam limiting devices: cones, diaphragms, light beam collimator, beam cantering device, methods to verify beam centering and field alignment; grids; design and control of scattered radiation, grid ratio, grid cut-off, parallel grid, focused grid, crossed grid, grided cassettes, stationary and moving grid potter Bucky diaphragm, various types of grid movements; single stroke movement, oscillatory movement and reciprocator movement. **Fluoroscopy**: Fluorescence and phosphorescence - description, fluorescent materials used in fluoroscopic screens, construction of fluoroscopic screen and related accessories, tilting table, dark adaptation.	12

	Image intensifier - Construction and working, advantages over fluoroscopic device, principles and methods of visualising intensified image, basic principles of closed-circuit television camera and picture tube. Vidicon camera, CCD. Automatic brightness control, automatic exposure control, chamber selection during fluoroscopy. Serial radiography: Manual cassette changer, rapid automatic film changer, basic principles of cine fluoroscopy and angiography use of grid-controlled x-ray tube.	
II	**Radiographic and Image Processing Techniques** **Radiographic Film**: Structure of film emulsion-film characteristics (speed, base + fog, gamma, latitude)-effect of grain size on film response to exposure, interpretation ofcharacteristicscurve-GrainTechnology-Gelatin-Basicfilmtypes-Filmformatsandpacking-Direct exposure dualities films-Single coated emulsions-Films for specialized use manufacturing process. Structure properties of different parts, handling film wrappings Handling of exposed and unexposed films Types, applications, advantages/limitations of different types, safe light requirements. **Sensitometer** : Photographic density-characteristic curve-information from the characteristic curve-speed Vs definition. Storage of X-ray film. **Intensifying screens** : Structure and functions, common phosphors used-types, screen mounting, care and maintenance of film screen contact. Intensifying factor-speed and detail – cross over effect – resolution – mottle - reciprocity-screen asymmetry-cleaning. New phosphor technology – influence of kilo voltage. Photo- stimulable phosphor Imaging. **Cassettes** : Structure and function-Types-single, gridded, film holder-Design features andconsiderationwithloading/unloading-Careandmaintenance(cleaning). **Processing** : manual processing-care of processing equipment-automatic processor-manual VS automatic processing-principles and typical equipment Micro processor controlled - Cineprocessing-Daylightsystems-Processingfaults-maintenance.Image processing in digital radiography systems: Post processing techniques in console using CR, DR and flat panel fluoroscopy systems	12
III	**Digital Radiography**	12

	Automatic Film Processor. Functions of various components. Film roller transport-transport time, film feed system. Importance and relation to temp, fixed and variable time. Care and maintenance (cleaning routine and methods of cleaning). **Radio graphic image**-components of image quality-un sharpness in radiographic image-contrast of the radiographic image-distinctness of the radiographic image-size, shape and spatial relationships. **Factors affecting Image Quality**: Meaning of radiographic image contrast, density, resolution, sharpness, magnification and distortion of image, noise and blur. Radiographic illuminators and viewing conditions, visual acuity and resolution. Presentation of radiographs-opaque letters and markers-Identification of dental films-preparation of stereo radiographs –viewing conditions. Monitor Images-Characteristics of the video image-television camera-imaging camera. Laser-light and laser-laser imaging-laser imagers-imaging plates-Dry cameras.	
IV	**Modern Radiological Equipment including Physics** 1.Special radiological equipment: Portable and mobile x-ray units, 2.Computed radiography: its principle, physics & equipment. Digital Radiography. Flat panel digital fluoroscopy and radiography system, Direct and indirect digital radiography and fluoroscopy systems. Digital radiography and Computed radiography its advantages, disadvantages and applications.	12
V	**Contrast agents** Contrast Media Types, composition, uses, contraindications Definitions : Air, Gasses. Radio paque : Barium Compounds, Aqueous Iodine Compounds, Oily Iodine Compounds, Other. Pharmacology: Barium Compounds & Iodine Compounds : Patient History/Allergy, Chemical Composition, Patient Precautions, Patient Reactions, Emergency Care. Methods of Administration:	12

	Systemic: Oral, Rectal, Tube, Catheter, Inhalation. Parental: Intravenous, Intra-Arterial, Intra Spinal. Administration Technique: Oral (Spoon, Cup, Capsule), Tube/Catheter, Naso gastric, Urinary, Enema, Other. Barium Swallow-Barium meal series- small bowel enema, double and single contrast, sinograms, fistulograms, IVU, retrograde pyelogram, MCU	
PRACTICAL		
I	**Skeletal system**	36
II	**Skull:** Basic projections for cranium, facial bones, nasal bones and mandible. Technique for Petrous temporal for mastoids. Internal auditory canal. – Accessory nasal sinuses. Temperomandibular joint. - Orbit and optic foramen. –Zygomatic arches. Styloid process. -Pituitary fossa. -Jugular foramen.	36
III	**Upper respiratory system**- Technique for postnasal airways, larynx, trachea, thoracic inlet, Valsalva manoeuvre. -Phonation. **Lungs and Media sternum**: Technique for routine projections- Supplementary projections: Antero-posterior, obliques, lordotic, apical projection, use of penetrated posterior-anterior projection. -Expiration technique. –Technique for pleural fluid levels and adhesions.	36
IV	**Abdominal viscera**- Technique for plain film examination. Projection for acute abdomen patients. –Technique to demonstrate : Foreign bodies, Imperforations.	36
V	**Pelvic girdle and hip region**: Technique for whole pelvis. Ilium, ischium, pubic bones, Sacro iliac joint, symphysis pubis, hip joint, acetabulum neck of femur, greater and lesser trochanter. Supplementary techniques-Congenital dislocation of hip, Epiphysis of femur Lateral projections for hip joints to show femoral head and neck relationship	36

COURSE OUTCOMES:

- Should be able to perform X RAYS of skull, upper respiratory systems, lung and mediastenum, abdominal viscera, pelvic girdle and hip region independently.
- Assist in specialized contrast agent procedures.
- Understand the applications of modern radiological equipment.

REFERENCE BOOKS:

1. Textbook of radiology for residents and technicians – Satish K Bhargava- 5th edition
2. Handbook of Medical Radiography latest edition by C Ram Mohan
3. Radiographic positioning Niranjan Baghel.
4. Johns HE, Cunningham JR. The Physics of Radiology. 4th edition.

CLINICAL POSTING – II

120HRS. 4 CREDITS

Students will gain additional skills in clinical procedures, interaction with patients and professional personnel. Students apply knowledge from previous clinical learning experience under the supervision of a senior technologist. Students are tested on intermediate clinical radio diagnosis skills.

SEMESTER – IV

ULTRASOUND PHYSICS

INTRODUCTION:

This subject is to provide an outline of basic Physics of ultrasound, Digital Mammography and its applications in diagnostic radiology. This gives an broad view of iamge transfer, HIS and PACS. This also gives an insight on the working of the DSA and DEXA with special emphasis on applied aspects.

COURSE OBJECTIVES:

- To train regarding techniques, Preparation & Positioning of patient for ultrasound imaging.
- To know about mammography procedures.
- To know about Doppler studies.

SYLLABUS

Hours: Theory 30 & Practical 75

Credits: Theory 2 & Practical 2.5

PAPER I

NO. OF UNITS	TOPIC	NO. OF HOURS
I	**PHYSICS OF ULTRASOUND** Basic Acoustics, Ultrasound terminologies: acoustic pressure, power, intensity, impedance, speed, frequency, dB notation: relative acoustic pressure and relative acoustic intensity. Interaction of US with matter: reflection, transmission, scattering, refraction and absorption, attenuation and attenuation coefficients, US machine controls, US focusing. Production of ultrasound: Piezoelectricity, Medical ultrasound transducer: Principle, construction and working, characteristics of US beam.	5
II	Ultrasound display modes: A, B, M, Real-time ultrasound: Line density and frame rate, Real-time ultrasound transducers: mechanical and electronic arrays, ultrasound artifacts, ultrasound recording devices, and Distance, area & volume measurements. Techniques for imaging different anatomic areas, ultrasound artifacts, biological effects and safety	7
III	**Ultra sonography/ Doppler studies** Doppler Ultrasound- Patient preparation for Doppler, Doppler artifacts, vascular sonography, Techniques of sonography-selection- Preparations - instructions and	8

	positioning of patient for TAS, TVS, TRUS, neck USG and extremities- patient care and maintenance protocols clinical applications display methods –quality image reproducible extend – biopsy procedures, assurance to patients. Ultrasound Artifacts USG Contrast agents Harmonic imaging Extended FOV imaging 3D US imaging: acquisition methods & reconstruction 4D & 5D US imaging	
IV	Neuro sonogram, Sono hysterography, Sono urethrography, Elastography, Musculoskeletal USG. Digital subtraction angiography equipment-principle, advancements and applications.	**5**
V	Digital Mammography, DEXA equipment-principle, advancements and applications. Tele radiology HIS,RIS and PACS	**5**

PRACTICAL

NO. OF UNITS	TOPIC	NO. OF HOURS
I	Urethrogram, HSG	20
II	T-Tube cholangiogram, operative cholangiogram (on table in theatre).	10
III	Patient positioning for Doppler.	15
IV	**Salivary glands** : Routine technique, procédure–sialography,.	15
V	Dacrography, Sialogram	15

COURSE OUTCOMES:

- Should be able to understand the ultrasound physics
- Assist in ultrasound procedures.
- Understand the applications of ultrasound techniques.
- Should be able to handle and perform the digital mammography equipment.

REFERENCES:

1.Textbook of radiology for residents and technicians – Satish K Bhargava- 5th edition

2.Handbook of Medical Radiography latest edition by C Rammohan

3.Radiographic positioning Niranjan Baghel

4.Clarks proedures in diagnostic imaging by Whitley

5.Radiologic science for technologist's 11th edition Elsevier

6.Physics and technical aspects diagnostic ultrasound by dinesh k baghel

CLINICAL RADIOGRAPHY WITH SPECIAL RADIOGRAPHY PROCEDURES

INTRODUCTION:

This course is aimed at making the student understand the principles of clinical radiography positioning including dental and soft tissue radiography. This deals with the applied aspects of the Modern Radiological equipment and use of the contrast media in various contrast procedures. It gives an outline of the basic principle and operative procedure done in interventional radiography.

COURSE OBJECTIVES:

- To train regarding techniques of Newer Interventional Radiographic Imaging Techniques including Patient Care
- To train on contrast radiographic procedures.
- To know about Dental radiography procedures.

SYLLABUS

Hours: Theory 60 & Practical - 210

Credits: Theory – 4 & Practical - 7

PAPER II

NO. OF UNITS	TOPIC	NO. OF HOURS
I	**Clinical Radiography Positioning** 1.Operationtheatre techniques 2.Traumaradiography/Emergency radiography 3.NeonatalandPediatricRadiography, 4.TomographyandTomosynthesis 5.ForensicRadiography **Skeletal system:** **Upper limb**: Technique for hand, fingers, thumb, wrist joint carpal bones, forearm, elbow joint, radio-ulnar joints and humerus, supplementary techniques for the above. Eg. Carpal tunnel view, ulnar groove, head of the radius, supracondylar projections. **Lower limb**: Technique for foot, toes, great toe, tarsal bones, calcaneum, ankle joint, lower leg, knee, patella & femur. Supplementary techniques: Stress view for torn ligaments, Subtalar joint and talocalcaneal joint. Inter condylar projection of the knee Tibial tubercle.	12

	Length measurement technique	
II	**Shoulder girdle and thorax**: Technique for shoulder joint, scapular, clavicle, acromio clavicular joints, sternum, ribs, sterno-clavicular joint. Supplementary projections and techniques Recurrent dislocation of shoulder. Traumatic dislocation of shoulder. Cervical ribs. **Vertebral column**: Technique for atlanto-occipital joint, cervical spine, cervico thoracic spine, thoracic spine, thoraco-lumber spine, lumbo-sacral spine, Sacrum and coccyx. Supplementary techniques to demonstrate: Scoliosis Kyphosis Spondylolisthesis Disc lesion Union of spinal graft.	**12**
III	**Pelvic girdle and hip region**: Technique for whole pelvis. Ilium, ischium, pubic bones, Sacro iliac joint, symphysis pubis, hip joint, acetabulum neck of femur, greater and lesser trochanter. Supplementary techniques-Congenital dislocation of hip, Epiphysis of femur. Lateral projections for hip joints to show femoral head and neck relationship.	**12**
IV	**Skeletal survey**: Skeletal survey for metabolic bone disease, metastases, hormonal disorder, renal disorders. **Skull:** Basic projections for cranium, facial bones, nasal bones and mandible. Technique for Petrous temporal for mastoids. Internal auditory canal. – Accessory nasal sinuses. Temperomandibular joint. Orbit and optic foramen. –Zygomatic arches. Styloid process. Pituitary fossa. - Jugular foramen. **Dental Radiography**- Technique for intra oral full mouth. - Occlusal projections. – Extraoral projections including ortho pan tomography. – Supplementary techniques. **Special radiographic procedures** • Responsibility of Radiographers during Radiological Procedures. • Preparation of Patient for Different Procedures. • Contrast Media-Positive and Negative, Ionic &Non–Ionic • Adverse Reactions to Contrast Media and Patient Management	**12**

	• Emergency Drugs in the Radiology Department • Emergency equipment's in the Radiology Department • Aseptic technique Indications, contraindications, basic techniques and relationship to other techniques of the following special procedures **Urinary system:** Intravenous urography**,** Retrograde pyelography**,** Antegrade pyelography Cystography and micturating cyst urethrography**,** Urethrography (ascending)**,** Renal puncture **Respiratory system**: Bronchography: Awareness **Sinuso graphy**: Routine technique and procedure. **Tomography:** General principles. Estimation, selection of depth of layer. Layer thick ness required for different examination. Spacing of layers. Types and advantages of various movements. Choice of tomo graphic movement-exposure factor. Sequential, horizontal and multi section tomography. Application of tomography to specific regions. **Soft Tissue Radiography:** High and low kilo voltage technique; differential filtration non-screen technique-simultaneous screen and non-screen technique**.** Multiple radiography. Uses of soft tissue radiography. **High kV Radiography:** General principles**,** Relation to patient dose**,** Change in radiographic contrast. Scatter elimination; beam collimation; grid ratio. Speed and type of grid movement. Radiographic factor: application and uses. **Localization of foreign bodies:** General location principles. Ingested; inhaled; inserted; embedded foreign bodies. Foreign bodies in eye. Preparation of the area to be investigated. Appropriate projection for all**,** Techniques to locate non-opaque foreign body.	
V	**Newer Imaging Techniques including Patient Care Interventional Radiography** Basic angiography and DSA: History, technique, patient care, Percutaneous catheterization, catheterization sites, Asepsis Guide wire, catheters, pressure injectors, accessories Use of digital subtraction-single plane and biplane All forms of diagnostic procedures including angiography, angioplasty, biliary examination, renal evaluation and drainage procedure. **Vascular Imaging Equipment**: Introduction, historical developments, Principle, scanned projection radiography, digital subtraction angiography, applications and definition of terms	**12**

PRACTICAL:

NO. OF UNITS	TOPIC	NO. OF HOURS
I	**Gastrointestinal Tract :** Fluoroscopy, general considerations, responsibility of radiographers Barium enema-double contrast barium enema	**40**
II	ERCP, PTBD, Barium swallow, pharynx and oesophagus, Barium meal and follow through.	**50**
III	small bowel enema, Water soluble contrast media-e.g. Gastro griffin studies	**30**
IV	**Biliary system** : Plain film radiography, Intravenous cholangiography,	**45**
V	Percutaneous cholangiography, Operative cholangiography.	**45**

COURSE OUTCOMES:

- Should be able to understand the interventional radiology procedures
- Understand the soft tissue radiography techniques.
- Should be able to perform contrast radiographic procedures independently

REFERENCES:

1. Textbook of radiology for residents and technicians – Satish K Bhargava- 5th edition
2. Handbook of Medical Radiography latest edition by C Rammohan
3. Radiographic positioning Niranjan Baghel
4. Diagnostic Radiology and imaging for technicians by shastri 1st edition.

CLINICAL POSTING – III

165 hrs. Credits 5.5

Students will gain additional skills in clinical procedures, interaction with patients and professional personnel. Students apply knowledge from previous clinical learning experience underthesupervisionofaseniortechnologist.Studentsaretestedonintermediateclinicalradio diagnosis skills.

SEMESTER V

PAPER I

RADIOGRAPHIC TECHNIQUES AND PHYSICS OF CT IMAGING TECHNOLOGY

INTRODUCTION:

This subject is to provide an outline of basic Physics of CT Imaging Technology, Advanced Computed Tomography techniques, CT scan studies acquisition/protocols. This also has emphasis on Cross-sectional CT anatomy and the CT contrast procedures indications and contraindications to improve the students understanding of the technical and diagnostic equipment used.

COURSE OBJECTIVES:

- Know about basic principle of working of CT and cross-sectional anatomy.
- To train in various protocols techniques in CT procedures and contrast CT procedures.
- To know about how to do the image processing and image reconstruction in CT.
- To know basic principle of working of PET CT.

SYLLABUS

Credits: Theory - 4 & Practical – 9.5

Hours: Theory 60 & Practical – 285

NO. OF UNITS	TOPIC	NO. OF HOURS
I	**Introduction to CROSS Sectional Anatomy &Terminology**- V SEM 1 UNIT Sectional planes, Anatomical relationships/terminology **Anatomy of the upper thorax**-Surface anatomy relationships, Bony structures and muscles, Blood vessels. Divisions of the mid-thorax, heart and great vessels-Lungs, heart and great vessels, Oesophagus **CT/MRI Images of the Thorax** - Normal and abnormal imaging. **Anatomy of the Abdomen**- Major organs and their accessories, Abdominal blood vessels **CT/MR Images of Abdomen** – Normal and pathologic anatomy of the Pelvis- Bony structures and associated muscles, Digestive and urinary systems **Reproductive Organs** - Normal and abnormal imaging **CT/MR Images of the Male/Female Pelvis**- Normal and pathologic **Neuro Anatomy**-Scan planes **Brain** –Cerebral hemispheres, Sinuses, Ventricles, Brainstem and associated parts, Arterial/venous systems, Basal ganglia, Cranial nerves **Spine**- Vertebra and disc, Spinal cord and meninges **Neck**-Arterial/venous systems, Muscles, Glands and pharynx	**15**
II	Physics of CT Imaging Technology: Basic Computed Tomography- Basic principles of CT, generations of CT, CT instrumentation, image formation in CT, CT image reconstruction, Hounsfield unit, CT image quality, CT image display.	**15**
III	Advanced Computed Tomography: Helical CT scan: Slip ring technology,	**10**

	advantages, multi detector array helical CT, cone –beam geometry, reconstruction of helical CT images, CT artifact, CT angiography, CT fluoroscopy, HRCT, postprocessingtechniques:MPR,MIP,MinIP,3Drendering:SSDandVR,CTDose,patientpreparation, Imaging techniques and protocols for various parts of body, CT contrast enhanced protocols – CT angiography –(Aortogram, selective angiogram head, neck and peripheral) image documentation and Filing, maintenance of equipment and accessories. CT artifacts	
IV	CT scan studies acquisition/ protocols/techniques: CT of head and neck – thorax – abdomen – pelvis – Musculo skeletal system – spine– PNS. Anatomy – clinical indications and contraindications – patient preparation – technique – contrast media-types, dose, injection technique; timing, sequence - image display – patient care – utilization of available techniques & image processing facilities to guide the clinician- CT anatomy and pathology of different organ systems	**10**
V	**1. Angiography:** a. Carotid Angiography (4 Vessel angiography) b. Thoracic and Arch Aortography c. Selective studies: Renal, SMA, Coeliac axis d. Vertebral angiography e. Femoral arteriography f. Angio cardiography **2. Venography:** Peripheral Venography. Cerebral Venography. Inferior and superior venocavography. Relevant visceral phlebography. Cardiac catheterization procedures: PTCA, BMV, CAG, Pacemaker, Electrophysiology	**10**

PRACTICAL:

NO. OF UNITS	TOPIC	NO. OF HOURS
I	Patient preparation for CT Imaging and protocols for various parts of body.	50
II	Patient preparation for CT contrast enhanced protocols.	45
III	Patient preparation for CT angiography, Aortogram.	50
IV	Selective angiogram head.	30
V	Selective angiogram neck and peripheral.	110

COURSE OUTCOMES:

- Should be able to understand the CT working principles.
- Assist in CT procedures
- Understand the CT imaging techniques.
- Should be able to undertake CT scans of brain, KUB, PNS, abdomen independently.

REFERENCES:

1. Textbook of radiology for residents and technicians – Satish K Bhargava- 5th edition
2. Handbook of Medical Radiography latest edition by C Rammohan
3. The physics of radiology and imaging by K. thayalan
4. A Guide on special radiographic investigations & techniques by Dr.kushal Gehlot and lalit Agarwal
5. CT protocals 1st edition by Dr. manoj kaur

PAPER II

REGULATORY REQUIREMENTS IN DIAGNOSTIC RADIOLOGY

INTRODUCTION:

This course is aimed to make the student to understand the Regulatory Bodies & regulatory Requirements: International Commission on Radiation Protection (ICRP)/National Regularity body (AERB-Atomic Energy Regulatory Board)-Responsibilities, organization, Safety Standard, Codes and Guides, Responsibilities of licenses, registrants &employers and Enforcement of Regulatory requirements. This also gives an insight about the pharmacokinectics of the contrast agents and emergency drugs used in the radiology department.

COURSE OBJECTIVES:

- Role of technologist in radiology department.
- To learn about QA & Radiation Protection.
- To make the students aware of AERB specifications for site planning and mandatory guidelines– Planning of X-ray rooms.
- To know about the pharmacokinectics of the contrast agents and emergency drugs used in the radiology department.

SYLLABUS

Hours: Theory 30 Credits: Theory – 2

NO. OF UNITS	TOPIC	NO. OF HOURS
I	Regulatory Bodies & regulatory Requirements: International Commission on Radiation Protection (ICRP)/National Regularity body (AERB-Atomic Energy Regulatory Board)-Responsibilities, organization, Safety Standard, Codes and Guides, Responsibilities of licenses, registrants &employers and Enforcement of Regulatory requirements.	5
II	Role of Radiographer in Planning, QA & Radiation Protection: Role of technologist in radiology department-Personnel and area monitoring., Setting up of a new X-Ray unit, staff Requirement	5
	AERB specifications for site planning and mandatory guidelines–Planning of X-ray rooms, dark rooms – Inspection of X-Ray installations - Registration of X-Ray equipment installation- Certification -Evaluation of workload versus radiation factors –Occupational exposure and protection Tools/devices	

III	ICRP, NRPB, NCRP and Who guidelines for radiation protection, pregnancy and radiation protection. NABH guidelines, AERB guidelines, PNDT Act and guidelines.	5
IV	Radiation detection and measurements: Principle of radiation detection-Basic principles of ionization chambers, proportional counters, G.M counters and scintillation detectors. Measuring system: free ionization chamber-thimble ionchamber-condenserchamber-secondarystandarddosimeter-filmdosimeter-chemicaldosimeter- Thermo Luminescent Dosimeter-Pocket dosimeter.	5
V	**Contrast Media & Pharmacokinetics:** Contrast Media Types, composition, uses, contraindications **A. Definitions:** Air, Gasses. Radiopaque: Barium Compounds, Aqueous Iodine Compounds, Oily Iodine Compounds, Other. **B. Pharmacology:** Barium Compounds & Iodine Compounds: Patient History/Allergy, Chemical Composition, Patient Precautions, Patient Reactions, Emergency Care. **C. Methods of Administration:** Systemic: Oral, Rectal, Tube, Catheter, Inhalation. Parental: Intravenous, Intra-Arterial, Intra Spinal. **D. Administration Technic:** Oral (Spoon, Cup, Capsule), Tube/Catheter, Nasogastric, Urinary, Enema, Other **General Pharmacology** Routes of drug administration. Pharmacokinetics – Absorption, Distribution, Metabolism, Excretion. Pharmacodynamics – Drug Receptor interactions, Factors modifying drug action, Adverse Drug Reaction, Pharmacovigilance. **Autonomic Nervous system** Cholinergic and Anticholinergic drugs. Adrenergic Agonists and Antagonists. Skeletal Muscle Relaxants. **Autacoids** Histamine and Antihistaminics. Prostaglandins and their analogues. Renin angiotensin aldosterone system. **Cardio Vascular System** Anti hypertensive drugs. Anti anginal drugs Local Anesthetics.	10

	Sedative – Hypnotics. Anti Epileptic drugs. Corticosteroids.	

COURSE OUTCOMES:

- Understand the NABH guidelines, AERB guidelines, PNDT Act and guidelines.
- Learn about the procedures of radiation detection and measurements.
- Understand the Registration process of X-Ray equipment installation- Certification.
- To make the students aware of personnel monitoring instruments.

REFERENCES:

1.Textbook of radiology for residents and technicians – Satish K Bhargava- 5th edition

2.Textbookof radiological safety 2nd edition by kuppusamy thayalan

3.AERB radiation protection rules 2004

4. IAEA radiation protection safety guidelines.

5. Essence of Pharmacology by K.D. Tripathi

6. Pharmacology and Pharmacotherapeutics by Satoskar

CLINICAL POSTING – IV

Credits: Practical – 5.5

Hours: Practical – 165

Students will gain additional skills in clinical procedures, interaction with patients and professional personnel. Students apply knowledge from previous clinical learning experience under the supervision of a senior technologist. Students are tested on intermediate clinical radio diagnosis skills.

SEMESTER VI

PAPER I

CROSS-SECTIONAL MR ANATOMY AND MR PHYSICS

INTRODUCTION:

This chapter make the students understand the Magnetic Resonance Imaging- its cross-sectional anatomy, principle, advancements and applications including Advanced technique & instrumentation of MRI, Methods of MRI protocols and safety aspects, MRI artifacts. This gives an insight of how to use various MRI instruments and to improve the students understanding of the technical and diagnostic equipment used.

COURSE OBJECTIVES:

- Know about cross-sectional anatomy & basic physics of MRI.
- To train in various protocols techniques in MRI procedures.
- To know about how to do the image processing and image reconstruction in MRI.
- To train about patient safety in MRI.

SYLLABUS

Hours: Theory 60 & Practical - 270

Credits: Theory - 4 & Practical - 9

NO. OF UNITS	TOPIC	NO. OF HOURS
I	**MRI IMAGING** 1.Magnetic Resonance Imaging- its principle, advancements and applications. 2.Fusion Imaging including PET-CT, PET- MRI. 3.Central Nervous System: a. Myelography b. Cerebral studiesc. Ventriculography 4. Arthrography: Shoulder, Hip, Knee, Elbow	15
II	**Advanced technique & instrumentation of MRI** Basic Principles: Spin – precession – relaxation time – pulse cycle – T1 weighted image – T2 weighted image – proton density image. Pulse sequence : Spin echo pulse sequence – turbo spin echo pulse sequence - Gradient echo sequence – Turbo gradient echo pulse sequence - Inversion recovery sequence – STIR sequence – SPIR sequence – FLAIR sequence – Echo planar imaging – Advanced pulse sequences.	15
III	**MR Instrumentation:** Types of magnets – RF transmitter – RF receiver – Gradient coils – shim coils – RF shielding – computers. Image formation: 2D Fourier	10

	transformation method – K-space representation – 3D Fourier imaging – MIP.MR contrast media – MR angiography – TOF & PCA – MR Spectroscopy – functional MRI	
IV	**MRI Scanners**: Methods of MRI imaging methods – Head and Neck ,Thorax, Abdomen, Musculoskeletal System imaging - Clinical indications and contraindications- types of common sequences effects of sequence on imaging - Protocols for various studies- slice section- patient preparation-positioning of the patient -patient care-calibration - paramagnetic agents and dose, additional techniques and recent advances in MRI - image acquisition-modification of procedures in an unconscious or un co-operative patient - plain studies- contrast studies -special procedures- reconstructions- 3D images- MRS blood flow imaging, diffusion/perfusion scans - strength and limitations of MRI- role of radiographer	10
V	Gating mechanism in MRI. MR artifacts, factors influencing image quality MRCP, DWI, SWI, perfusion	10

PRACTICALS

NO. OF UNITS	TOPICS	NO. OF HOURS
I	Patient preparation for MRI Imaging and protocols for various parts of body.	70
II	MR Angiography, (TOF, phase contrast and dynamic contrast MR angiography), Spectroscopy.	60
III	MRCP	40
IV	DWI	45
V	SWI, perfusion	55

COURSE OUTCOMES:

- Should be able to understand the MRI working principles.
- Understand the MRI procedures
- Perform the basic MRI imaging sequences of brain and spine.

REFERENCES:

1.Textbook of radiology for residents and technicians – Satish K Bhargava- 5th edition

2. The physics of radiology and imaging by K. thayalan

3. Concise text book of MRI physics and protocols by maajid ud din malik

4. MRI Made easy 3rd edition by Govind B chavhan

PAPER II

QUALITY CONTROL, QUALITY ASSURANCE AND RADIATION SAFETY

INTRODUCTION:

This course is aimed to make the student to understand the Quality assurance activities Acceptance; Routine testing; Evaluation of results of routine testing; Quality assurance practical exercise in the X ray generator and tube; Image receptors from processing; Radiographic equipment; Fluoroscopic equipment; Mammographic equipment; Conventional tomography and Computed tomography.

COURSE OBJECTIVES:

- To learn about Care and maintenance of diagnostic equipment: General principles and preventive maintenance for routine daily, Weekly, monthly, quarterly, annually, special care of mobile equipment.
- Know about Biological effects of radiation.
- AERB protocols for Diagnostic Radiology.

SYLLABUS

Hours: Theory 30 Credits: Theory – 2

NO. OF UNITS	TOPICS	NO. OF HOURS
I	**Quality Control in Radiology and Radiation Safety** Objectives of quality Control: Improve the quality of imaging there by increasing the diagnostic value; to reduce the radiation exposure; Reduction of film wastage and repeat examination; to maintain the various diagnostic and imaging units at their optimal performance. Quality assurance activities: Equipments election phase; Equipment installation and acceptance phase; Operational phase; Preventive maintenance.	5
II	Quality assurance program at the radiological faculty level: Responsibility; Purchase; Specifications; Acceptance; Routine testing; Evaluation of results of routine testing; Quality assurance practical exercise in the X ray generator and tube; Imagereceptorsfromprocessing;Radiographicequipment;Fluoroscopicequipment; Mammographicequipment;Conventionaltomography;Computedtomography, Film processing, manual and automatic; Consideration for storage of film and chemicals; Faults tracing; Accuracy of imaging-image distortion for digital imaging devices. LASER printer calibration. Quality assurance program tests:	10

	General principles and preventive maintenance for routine, daily, weekly, monthly, quarterly, annually–machine calibration. Basic concepts of quality assurance LASER printer-Light beam alignment; X-ray out-put and beam quality check ; KVp check; Focal spot size and angle measurement; Timer check; mAs test; Grid alignment test; High and low contrast solutions; Mechanical and electrical checks; Cassette leak check; Proper screen-film contact test; Safe light test; Radiation proof test; Field alignment test for fluoroscopic device; Resolution test; Phantom measurements-CT, US and MRI. Quality assurance of film and image recording devices: Sensitometry ; Characteristic curve; Film attitude; Film contrast; Film speed Resolution; Distortion; Artifacts of films and image recording. Monitor calibration. SMPTE pattern Maintenance and care of equipment : Safe operation of equipment; Routine cleaning of equipment and instruments; Cassette, screen maintenance; Maintenance of automatic process or and manual processing units; Routine maintenance of equipment's; Recordkeeping and logbook maintenance; Reject analysis and objectives of reject analysis program. Care and maintenance of diagnostic equipment : General principles and preventive maintenance for routine daily,Weekly,monthly,quarterly,annually:careinuse,specialcareofmobileequipment.	
III	**Radiation safety in diagnostic Radiology** **Radiation Quantities and Units:** Radiation-Radioactivity-Sourcesofradiation-naturalradioactivesources-cosmicraysterrestrialradiation—manmaderadiation sources. Units of radiation-Qualityfactor-Flux-Fluence-Kerma-Exposure-Absorbeddose-EquivalentDose-WeightingFactors-EffectiveDoseOccupationalExposure Limits-Dose limits to public. **Biological Effects of radiation**: Ionization, excitation and free radical formation, hydrolysis of water, action of radiation on cell-Chromosomal aberration and its application for the biological dosimetry - Effects of whole body and acute irradiation, dose fractionation, effects of ionizing gradiation one ach of major organ system Including fetus – Somatic effects and hereditary effects-stochasticanddeterministiceffects-Acuteexposureandchronicexposure-LD50-factorsaffectingradiosensitivity.Biologicaleffectsofnon-ionizingradiationlike ultrasound, lasers, IR, UV and magnetic fields.	**5**
IV	**Radiation detection and Measurements**: Ionization of gases- Fluorescence and Phosphorescence -Effects on photographic emulsion. Ionization Chambers – proportional counters- G.M counters- scintillation detectors – liquid	**5**

	semiconductor detectors–Gamma ray spectrometer. **Measuring systems–**free air ionization chamber–thimble ion chamber – condenser chamber – Secondary standard dosimeters – film dosimeter–chemical dosimeter– Thermo luminescent Dosimeter. -Pocket Dosimeter-Radiation survey meter-wide range survey meter-zone monitor-contamination monitor-the principle function and uses. Advantages & disadvantages of various detectors & its appropriateness of different detectors for different type of radiation measurement. Dose and Dosimetry, CTD Dose Index (CTDI, etc.), Multiple Scan Average Dose (MSAD), Dose Length Product (DLP), Dose Profile, Effective Dose, Phantom Measurement Methods, Dose for Different Application Protocols, Technique Optimization. Dose area production fluoroscopy and angiography systems, AGD in mammography.	
V	**Radiation protection**: Radiation protection of self and patient- Principles of radiation protection, time-distance and shielding, shielding calculation and radiation survey–ALARA-personnel dosimeters (TLD and film batches)-occupational exposure. Radiation Hazard evaluation and control: Philosophy of Radiation protection, effects of time, Distance& Shielding. Calculation of Workload, weekly calculated dose of radiation worker & General public Good work practice in Diagnostic Radiology. Planning consideration for radiology, including Use factor, occupancy factors, and different shielding material.	**5**

COURSE OUTCOMES:

- Understand the principles of radiation protection.
- Learn about the radiation quantities and units.
- Understand the emergency procedures in Diagnostic radiology.
- Radiation safety Awareness and dose limits prescribed by AERB.

REFERENCES:

1. Textbook of radiological safety 2nd edition by kuppusamy thayalan
2. Textbook of radiobiology by Eric J Hall
3. AERB radiation protection rules 2004.
4. IAEA radiation protection safety guidelines.

CLINICAL POSTING - V

Hours 180 Credits 6

Students will gain additional skills in clinical procedures, interaction with patients and professional personnel. Students apply knowledge from previous clinical learning experience under the supervision of a senior technologist. Students are tested on intermediate clinical radio diagnosis skills.