TWO YEARS POST MATRIC TEACHING PROGRAM OF PARAMEDICS

F. Sc. (Medical Imaging Technology)

CURRICULUM WING
MINISTRY OF EDUCATION, ISLAMABAD
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PREFACE

Live nations continue to develop. New fields emerge with the laps of time and pace of development. Medical Technology has gained importance with technological development in diagnostic, therapeutic, and preventive aspects of health care delivery system. This has produced a need for trained and skilled manpower in this field. Present curriculum is one of the outcomes of that necessity.

These curricula will not only help in providing a base for better healthcare but also decrease unemployment in our country. It will open up new avenues for our youngsters.

Curriculum development is a hectic task and is not possible in a day. Present curriculum also passed through many phases of development. Initially it was developed by consultants of Pakistan Institute of Medical Sciences on request of the then Project Director, College of Medical Technology, PIMS 1987.

In 1990, it was later on suggested by the faculty of the College of Medical Technology to bring it at par with F. Sc. The Committee of two members i.e. Dr. M.A. Aziz Shahzada and Engr. Sher Afzal Awan expanded it over a period of two years. The same curricula was revised and updated by Engr. Sher Afzal Awan in 1995.

In 1995, equivalence it was granted by IBCC on continuous struggle for three years of Lt.Col.{r} Dr. Azra Javed. Qureshi, Principal, CMT.

The college approached Curriculum Wing, Ministry of Education in 2001 for approval and standardization. The process continued till to date. National Review Committee, constituted by the Curriculum Wing has discussed it in its meeting held from 18th May 2004 to 20th May 2004. The Committee has approved this draft.

Curriculum development is a continuous process. It may have many mistakes or it may be better than this. We have tried our best to update it so that trained people under this program may fulfill the needs and requirements of the hospitals in Pakistan.

This curriculum is first trail of its kind in Pakistan in the field of medical education. All our colleagues have made the history by taking part its preparation, review and approval. We do hope that both educationists and Paramedical Institutes will accept it. At last, we thank toLt.Col.(r) Dr. Azra J. Qureshi, Mr. Sher Afzal Awan (PIMS) and Mr. Saeed Ahmad Meher (Curriculum Wing) for their valuable co-operation and contribution in completing this difficult task.

The Ministry of Education appreciates the contributions of all the Provincial Governments and Health Departments.
(Prof. Dr. Haroona Jatoi)
Joint Educational Advisor
Curriculum wing.
Ministry of Education Islamabad.
ACKNOWLEDGEMENT

Grateful acknowledgement is hereby made to all the contributors from all provinces of Pakistan, from Ministry of Education and different hospitals at Federal area Islamabad who reviewed drafts of curricula of five disciplines and gave fruitful suggestions for its improvement.

Above all, I am indebted to Prof. Dr. Haroona Jatoi, Mr. Aurang Zeb Rehman and Mr. Saeed Ahmad Meher (Curriculum Wing) for their valuable co-operation and contribution in completing this difficult task.

My gratitude goes to Engr. Sher Afzal Awan, Registrar, CMT for his contribution in developing, updating, incorporating changes proposed by NRC and giving it a present shape.

I am also indebted to all the secretarial staff of Curriculum Wing and CMT for helping in clerical work. And above formal way of acknowledgement to past concerns, gratitude goes to all those who will use it in shaping the future of coming generations in the field of medical education.

I am also indebted to W.H.O.EMRO for its contribution in standardization of curricula for Paramedics Resource development in Pakistan.

Principal,
College Of Medical Technology,
Pakistan Institute of Medical Sciences,
Islamabad.
AIMS AND OBJECTIVES OF THE COURSE

A) To prepare the students to become an efficient X-Ray Technologist, well versed with the techniques and background analysis, in all the branches of the Radiation medicine. For this purpose the teaching in the special technical subjects involves lectures; practical that include demonstration and bench work; and job training of both “Observing Type” and “Involvement Type” in the latter the students participate in duty performance in the working X-Ray Laboratory.

B) To make the course and qualification comparable with similar programs in the country so that the candidates have a competitive standing in job seeking as well as in eligibility for entry into a graduation course in the technology in any such Institute.
<table>
<thead>
<tr>
<th>Name of Subject</th>
<th>Theory / Practical</th>
<th>Topics Included</th>
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<td>Anatomy, Physiology, Public Health and First Aid</td>
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RADIOGRAPHIC TECHNOLOGY
PART - I
HOURS DISTRIBUTION PER WEEK

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HOURS DISTRIBUTION PER YEAR

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PART – II
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<td>440</td>
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PHYSICS AND CHEMISTRY

1. The nature of Science, Divisions of Science, and Scientific method.
2. The Measurement – Metric System, scientific notation, units of mass, length and volume.
4. Gravity – speed, velocity and acceleration, center of gravity, weight and mass.
8. Pressure – Definition, pressure in hydrostatic fluids, pressure in flowing liquids.
9. Gas Laws – Boyle’s and Charles laws, gas laws applicable to respiratory process, effects of changes in atmospheric pressure on physiology of the human body.
12. Sound – How it is produced, characteristic, transmission, reflection of sound, echoes, ultrasound.
14. Magnets and Magnetism – Properties, magnetic field, magnetic lines of force, electromagnet, magnetic effect of electric current, Motor and generator effect of current, magnetic and electric induction, Transformer.
15. Charge – Coulomb’s law, capacitor and capacitance, capacitor in series and in parallel.
16. A.C. Definition, RMS value, Peak value Sine wave.
17. Electromagnetic Radiation – Spectrum, ionization, excitation, Inverse Square law, frequency, wave length, terms and their definitions.
18. Composition of Substance – Atoms and molecules, symbols, formulae, Elements and compounds, chemical formula.
20. Water – physical and chemical properties, Deliquescent, efflorescent, hygroscopic substances, solvent properties, Hydrolysis, Water cycle, impurities, hard and soft water.
22. Acid, Bases, and salts.
23. pH Scale and buffer system.
24. Electrolytes and electrolysis.
25. Amines and amides.
27. Carbohydrates.
28. Lipids.
**Practical Chemistry**

1. How fitting up a wash bottle is prepared?
2. To pacify the given sample of impose naphthalene crystallization.
3. To pacify the given sample of naphthalene by sublimation.
4. To determine the melting & boiling point of organic compound.
5. To prepare the standard solution of acid or Base.
6. To prepare a standard solution of exotic acid and with its help standardize a solution of NaOH.
7. To prepare approximates N/10 solution of H₂SO₄ determine its exact normality by titrating it against standard N/10 NaOH?
8. To standardize a given solution by direct method.
9. To standardize a given solution by indirect method.

**Practical Physics**

a. To find the unknown force.
b. To find the center of gravity of an irregular shape.
c. To verify the law of reflection.
d. To find the path of light passing through a prism.
e. To find the focal point of a lens.
f. Determine the critical angle of glass using a glass prism.
g. Determine the focal length of convex lens.
h. To find the reflective index of a liquid using a concave mirror.
i. Determine the speed of sound at a room temperature.
APPLIED COMPUTER SCIENCES

Note: This is an introduction to computer science. A brief description and definitions of terms will be taught to the students.

1. An overview of Computer system.
2. The shapes of computer today—Super Computer, Main frame, mini computer, Works stations and PC.
3. Input methods—Keyboard, Mouse,
5. Monitors and sound system—Monitors—PC. Projectors, sound system.
6. Printer and brief introduction to its types.
7. Transforming data into information representation, process, speed etc.
8. CPU—types with definition
10. Measuring drive information—access time, file compression, transfer rate, interface standard.
11. Basic of operating system—interface, programme, files, hardware and software management
13. Words processing and Desk tope Publishing software.
15. Presentation programme
17. Networking basics—brief of use, structure, LANs, Media, Hardware and Software.
18. Networking—Standard telephone lines, digital lines, Network in the home.
19. Internet basics
20. Accessing, connecting, working on internet, introduction to DICOM, PACS.
21. Working with images.
23. Understanding multi-media.
24. Creating and distributing media contents.
25. Basics of information system—Use, Parts.
26. Building information system—five phases—need, Design, development, implementation, maintenance.
27. Creating programmes—definitions of programme and approaches.
28. Programming languages and system development life cycle.
29. Ergonomics, health and privacy issues.
30. Brief of computer crimes, Viruses, Theft and computer environment.
PATIENT SAFETY

1-10 **Electrical Hazards**

- Electrical current and body muscles
- Electric shock
- Defibrillators
- Pace makers
- High and low frequency electricity in medicine
- Classification of medical equipment
- Degree of protection in equipment
- Earth leakage current
- Maximum current limits and safety tests

11-15 **Fire and explosion in hospitals**

- Inflammable gases and liquids
- Static electricity
- Precaution against fire and explosion

16-26 **Surgical diathermy and other possible hazards in hospitals**

- Surgical diathermy and precautions
- Mechanical hazards
- Heat and light hazards
- Chemical burns

27-35 **Radiation**

- Non-ionizing radiation
- Ionizing radiation
- Microwave ovens
- Ultrasound therapy equipment
- Lasers

36-40 **Infection in hospitals**

- The hospital environment
- Pathogenic, non-pathogenic microgenisms
- Modes of spread of infection
- Kinds of infection
- Cross-infection
- Precautions and prevention.
BASIC MEDICAL SCIENCES
PART - I
ANATOMY

The depth of the subject will only be diagram and labeling of the diagram.

<table>
<thead>
<tr>
<th>Week</th>
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<tbody>
<tr>
<td>1.</td>
<td>Introduction</td>
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<tr>
<td>2-3.</td>
<td>The study of human cell and functions of organelles, Nucleus, DNA helix, RNA, genetic code, Chromosomes. Cell Division Mitosis and Meiosis of cell</td>
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</table>
| 4-9. | **BASIC TISSUES**  
- Different Types of tissues.  
- Connective tissues.  
- Epithelial tissues.  
- Muscle tissues.  
- Nervous tissues.  
- Blood tissues. |
| 10-11. | The circulatory system- Structure of heart. Different chambers of heart, main arteries arising from the heart and main veins of the heart, branches of arch of aorta, Thoracic aorta, abdominal aorta, main vessels of upper and lower limbs. |
| 12-13. | **Lymphatic System** |
| 14-17. | **The Gastro Intestinal Systems**  
- Mouth  
- Pharynx  
- Esophagus  
- Stomach  
- Small Intestine  
- Large Intestine  
- Accessory organs (Liver, Spleen, Pancreas & Gall Bladder) |
| 18-20. | **Respiratory System**  
1. Organs of respiration  
2. Upper respiratory tract  
3. Lower respiratory tract |
| 21-22. | **The Skin**  
- Epidermis  
- Dermis  
- Sebaceous glands  
- Nails |
23-25. The Nervous System
1. CNS central nervous system
2. Peripheral Nervous System
   - Different parts of nervous system
   - Structure of cerebrum, mid brain, cerebellum, pons and medulla oblongata, spinal cord and
   - Autonomic nervous system

26-28. The Endocrine Glands
Short description and position of:-
- Pituitary gland
- Thyroid gland
- Parathyroid gland
- Adrenal gland
- Hormones of Testis
- Prostate
- Ovaries
- Pancreas and Thymus

29-31. The urinary system
Structure of kidney, urethra, urinary bladder, prostate gland and ureter. Difference of right and left kidneys.

32-33. The Reproductive System
- Male reproductive system
- Female Reproductive System
- Different organs of male reproductive system, structure of testis, the scrotum, seminal vesicles, prostate gland, the penis and urethra.
- Different organs of females reproductive system, Mammary glands, Structure of ovaries, uterus, cervix and vagina,

34-35. The Skeleton
Different bones of skull. Bones of upper limbs, lower limbs, thorax, pelvis and vertebral column.
36-38. Structure of individual bones, scapula, humerus, radius, ulna, femur, tibia and hip bones, hands, foot, ribs, sternum, clavical, sacrum, thyroid, hyoid, */

The Joints
1. All joints and their movements
2. Main muscles of body.

39-40. The Special Senses:
Brief anatomy of eye. Three coats of eye ball. Brief anatomy of ear Outer, middle and inner ear, nose- inner and outer, tounge, salivary glands, skin.

Recommended Books:
PHYSIOLOGY

The physiology of the following topics will consist of brief description of the function of part of the body.

1-3. **The cell and its functions**
   1. Structure and Functions of a human cell
      The cytoplasm and its organelles
      Comparison with animal cell
      Functional system of the cell
   2. Endocytosis & Phagocytosis
      Ingestion and digestion by the cell
      Functions/Structures of Golgi apparatus
   3. Cell Division
      Mitochondria and reticulum.
      Cell reproduction.

4-9. **Tissues and fluids of body.**

10-11. **Cardiovascular system (Heart and circulation)**
   Description of Heart and vessels (arteries, vein, and capillaries)
   Cardiac cycle, diastole and systole
   Functions of atria and ventricles
   Functions of valves
   Heart pumping (work output of heart)
   Cardiac output, stroke volume etc.
   Heart sounds
   **Lymphatic system function**

12-14. **Respiratory System**
   Basic mechanism of respiration
   Inspiration expiration mechanism
   Pulmonary capacities and pulmonary volumes
   Respiratory rate and tidal volume definitions
   Functions of respiratory pathways (Chemical & Neural Control)
   Artificial respiration, mouth breathing
   Transport of oxygen and carbon dioxide in the blood and body fluids

15-18. **Gastro intestinal tract.**
   Ingestion of food, mastication (Chewing)/ Digestion and Swallowing
   Functions of stomach
   Storage function, mixing of food

19-20. **Secretions of GIT**
   Saliva, Salivary glands functions of
   Saliva, Gastric Secretion, Functions of
   Pancreatic secretion, Bile secretion and its function
Secretions of the small intestine, secretion of large intestine, Digestion and absorption of food

21-25. Metabolism
   Introduction to Fat and Protein Metabolism
   Introduction to Carbohydrates Metabolism, Role of glucose in Carbohydrate metabolism, Transport of glucose in body tissue, Lipid metabolism transport of lipids in the blood.
   Transport from the GIT, and fat deposits, Proteins metabolism, basic properties of protein, use of proteins for energy, Vitamins and their metabolic role.

   Endocrine glands and their hormones
   The pituitary hormones and their functions
   The thyroid hormone, The adrenocortical hormones
   Parathyroid hormones and their functions

29-32. Reproductive System.
   Functions of the male reproductive organs
   Functions of the female reproductive system
   Testosterone and other male sex hormones
   Pregnancy, lactation and female hormones

33-37. Special Senses
   Introduction to Sensory organs and their function
   The eye functions and elements of eye, Sclera, choroid retina, The eye as a camera, Sense of Hearing, tympanic membrane and external ear, middle ear and vesicles,
   Internal ear and its functions
   Conduction of sound to the cochlea
   The functions of Tongue and salivary glands.
   The functions of nose and tonsils / Adenoids.
   The functions of skin and its appendages

38-40. Nervous System
   General design of nervous system types and parts of nervous system Functions of brain, cerebrum cerebellum spinal cord. Cranial nerves. Autonomic nervous system (Parts and functions)
BASIC MEDICAL SCIENCES
PART - II
FIRST AID

1. First Aid
   - Definition
   - Principles
   - Actions at emergency

2. Dressing + Bandages
3. Short structure & function of respiratory system
4. Asphyxia
5. Assisted respiration
6. Short structure and function of C.V.S.
7. Shock (Circulatory failure) Patho-Physiology
8. Cardiogenic shock Treatment
9. Hypo-volumic shock (Haemotologic) with treatment other condition.
10. Anaphylactic shock
     - Signs
     - Symptoms
     - Treatment

11. Septic Shock
12. Neurogenic shock
13. Cardiopulmonary resuscitation principles practical demonstration.
14. Assessment of newborn
15. Resuscitation of newborn
16. Short structure & function of locomotive, Sprains and strains
17. Fractures, First Aid Management
18. Burns, Scalds causes and First Aid Management
19. Wounds cuts stabs and management
20. Management of Bleeding from wound/NOSE/mouth/misc.
21. Drowning-First Aid management
22. Road traffic accidents (First Aid Management)
23. Transport of injured persons especially spinal care
24. Care of Coma / stupor unconscious victim
25. Poisonings-Swallowed persons and first aid management
26. Poisonings inhalation poisonings first aid management
27. Bites Stings management human, cat dog insect
28. Snake bite and first aid management
29. Anaphylactic Shock and its management
30. Choking (Foreign body in airway)
31. Abdominal pain (First aid)
32. Sport injuries
33. Safety at home precautions / safety
34. Precautions at kitchen to avoid accidents.
35. Precautions at bathroom
36. Precautions in living room
37. Precautions at stairs and at terraces
PUBLIC HEALTH

1. **Introduction**: To health field, definition of health, preventive, social, community and family medicine.
2. Health care organization in Pakistan.
   
   i. General introduction to federal, provincial, divisional and district level organizational structure.
   
   ii. Role of paramedics in hospitals.

3-6. **AIR**

   Composition and functions-Pollution and pollution indicators-impurities in air-cleaning methods (an over view)

7-12. **WATER**

   Sources of water with special reference to Pakistan. Impurities-Safety-Purification, Natural and artificial methods.

13-17. **VENTILATION**

   Objectives and merits. Over crowing and its effects on human body. Natural ventilation and artificial ventilation.

18-25. **Wastage**


26-27. **Infection and disinfecting**

   Introduction-Terminology-Methods of disaffection.

28-29. Sources of infection-routes of transmission i.e., air, water and food.

30-39. **Communicable diseases**

   Introduction-EPI and diseases related to it, vaccination schedule. Communicable diseases like T.B., diphtheria, tetanus, polio, whooping cough and measles Epidemiology and prevention methods for above diseases.

40. **Family Planning**

   Need and objectives-general methods.
RADIOGRAPHIC TECHNIQUES
PART - I
ELECTRO-MAGNETISM

Weeks

1. Introduction to the course.
2. The structure of the atom.
3. Isotopes.
4. Ionization and excitation.
5. Electric charges.
7. Electric charge an electrical potential.
8. Capacitance and capacitors.
10. Resistance and ohms law.
11. Circuit laws.
12. Energy and power.
13. The heating effect of electric current.
14. Sources of electrical energy.
15. Magnetism-introduction.
16. The magnetic effect of electric current.
17. Applications of magnetic effect.
20. Introduction of A.C.
21. Transformer-theory.
22. Transformer-practical aspects.
26. Single phase three phase, comparison and contrast.
27. Electrical distribution system in Pakistan.
28. Different supply systems.
29. A.C. in three-phase system.
30. Introduction to electrical machines.
32. Motor-Principle, Main parts working.
33. Electrical measuring instruments and measurements.
34. Indicating instrument-types, Principle and working.
35. Thermionic emission and P.N. Junction.
36. Diode structures and working.
37. Characteristic of diodes.
38. Triode-its working and characteristics.
40. Introduction to amplification.
RADIATION PHYSICS

1. Structure of atom, definitions of terms.
2. Electromagnetic Radiation theory and proprieties.
5. The properties of x-rays.
6. The production of x-rays and interaction with targets.
7. Spectra of x-rays.
8. The factors affecting quantity and intensity.
9. The thermionic emission of cathode.
11. Practical aspects of x-rays.
12. Triode valve and semiconductors.
13. Cathode ray oscilloscopes.
14. Introduction to higher voltage rectifier circuits.
15. Self-rectifying circuits.
16. Half wave and Full wave pulsating voltage circuits.
17. Constant potential circuits.
18. The measurement of higher voltage.
19. Introduction to x-ray control, X-ray tube voltage (kV.), X-Ray tube current (MA).
20. Exposure controls.
22. The transmission of a homogeneous beam through a medium.
23. Absorption and scattering process.
24. The transmission of a heterogeneous beam through a medium and filtration.
25. The transmission of a beam through body tissues.
26. Shapes and fine details in the x-ray image.
27. Basis of x-rays measurement exposure, half value longer, Dose equivalent and other methods.
28. Introduction to radioactivity-discovery, emission, transformation process and branching.
29. Radioactive decay, artificial or induced radioactivity, exposure rate constant and used of radionuclides in medicine.
30. Introduction to Radiation protection, maximum permissible dose, protective materials and radiation.
31. Introduction to Nuclear medicine-properties of nuclides, organ specific up take, detection of radiation, radio nuclide imaging.
32. Physics of ultrasound-nature, generation, power and intensity.
33. Transmission of ultrasound through matters, ultrasonic scans safety.
34. Physical basis of tomography-introduction.
35. Introduction to computer and Computed tomography.
36. Physics of magnetic resonance imaging.
37. Introduction to laser and safety precaution concept of radiotherapy.
FILMS AND DARK ROOM TECHNIQUES

Physical Basis of radiography.

1. Image formation, distortion and blurring.
2. Composition and constituents of x-ray films.
3. Effects of x-rays on x-ray film-sensitivity.
5. Introduction to fluorescence Fluorescent materials.
8. Intensification factors.
10. Care and safety of screens and x-rays cassettes.
11. Variation of films and screens with patients thickness and an anatomical structure.
13. Methods of film labeling and identification, sizes etc.
15. Film development with manual and automatic techniques.
16. Defects in films
17. Introduction to automatic developers, materials used.
18. Introduction to different types of contrast media, official and trade names.
19. Contrast media dosage-methods and procedures.
20. Side effects of contrast media and reactions.
21. Treatment of reactions from contrast media.
22. Types of films used in ultrasound Methods of storing.
23. Use of computers in recording and storage of images.
24. Store keeping in radiology.
25. Inventory and ordering and reordering in radiology.
POSITIONING AND PROCEDURES

1. Introduction to the subject.
2-4. Positions and procedures of x-ray for all bones of upper limbs, quantity of kV. milliamp, seconds etc.
5-7. Bones of vertebral column, their positions including focusing, position of patient, kV. milliamp and seconds required, distance from the tube etc.

8. Bones of lower limbs including pelvis, their positions and kV, milliamp second required.
11-12. Digestive system - position and procedures.
13. Urinary system-position, procedure dyes and other medicines used to take x-rays dose required.
14. Human reproductive system positions and procedure kV. milliamp and second required.
17. Ear, Mastoid, and Temporal Bones-position procedures.
18. Respiratory system and heart
19-20. Paediatric Radiography
21. Fluro scopy-positions and procedures-comparison and contrast with conventional radiography.
22. Mammography.
23. Myelography.
24. Introduction to ultrasound, sonographic techniques, preparation and reassurance of patient.
26. Introduction to C.T.Scan
27. Isotope scamming-theory and practice.
29. Angiography – Diagnostic and Interventional
30. Emergency Radiography.
31. Radiography for foreign bodies.
32. Theater Radiography.
33. Ward Radiography.
34. Introduction to Lithotripsy
X-RAY EQUIPMENT

1-3. Components and controls of X-Ray circuits:

- High tension transformer
- Rectification of high tension (Half and full wave) kV control and indicators
- Filament and control of tube current
- Milliamperes indication
- Mains voltage compensation
- Main supply and the X-Ray set.

5-8. High tension generators:

- Rating of X-Ray generators
- Self-rectified high tension
- Full-wave rectified circuit
- Circuit comparisons
- Three phases full-wave rectified circuit
- Voltage waveforms are HT
- generator
- Constant potential circuit
- Failing load generators
- Shared generator.

9-11. Fuses, Switches and Inter locks:

- Fuses, Switches, Circuit Breaker
- Interlocking circuits.

12-15. Exposure switches and exposure timers:

- Switching system
- Timing systems
- Exposure switching and its radiographic applications.
- Choices of K.V. Contrast

16-23. Logic's

Binary counting system
Logic elements
Applications of logic circuits
Radiographic timing and switching circuit.

24-27. X-Ray Tubes

Construction of X-Ray Tubes
- Fixed anode X-Ray tube
- Rotating anode
- X-Ray tube
- Rating of X-Ray tube
- Faults in X-Ray tube
- Characteristics of X-Ray tubes
- Metal X-Ray tube
- X-Ray tubes for mammography
- Choice of an X-Ray tube
- Tube stands and tube support
- Filter types and uses
- Choices of kV and contrast
- Tube diaphragms
- Collimation
- Nature, types, methods and equipment.

28-29. Control of scattered Radiation:

- Significance of scatter
- Beam limiting devices
- Beam centering devices
- The secondary radiation grid
- Grid movements
- Assessment of grid functions
- Grids
- Construction and operation.
30-32. Portable and Mobile X-Ray Equipment:
   Main requirement-Portable X-Ray equipment-Mobile X-Ray equipment-capacitor
discharge mobile equipment -Cordless mobile equipment-operating theatre X-Ray
Equip.

33-35. Fluoroscopic
   Direct Fluoroscopy Fluoroscopic image.

36-38. Image Intensifier:
   TV process-X-Ray image intensifier tube-recording the intensified image-panel-
type intensifier.

39-40. Intensifying screens-Tomography-Basic theory and equipment.
RADIOLOGICAL ANATOMY

1. Surface Anatomy.
2. Anatomy of upper Limbs
3. Anatomy of lower Limbs including pelvis
4-5. Anatomy of vertebral column.
8. Anatomy of digestive system
10. Anatomy of male and female reproductive system.
11. Anatomy of skull, face, salivary glands & paranasal sinuses
<table>
<thead>
<tr>
<th>S.No.</th>
<th>Practical list of Radiological Anatomy</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Introduction to Regional Anatomy</td>
<td>1</td>
</tr>
<tr>
<td>2.</td>
<td>Demonstration on Anatomical Positions &amp; Plans</td>
<td>1</td>
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<tr>
<td>3.</td>
<td>Demonstration of Important Laval marks of head &amp; neck</td>
<td>1</td>
</tr>
<tr>
<td>4.</td>
<td>Demonstrations of important landmark of thorax &amp; abdomen.</td>
<td>1</td>
</tr>
<tr>
<td>5.</td>
<td>General demonstration of Skeleton &amp; types of bones</td>
<td>2</td>
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<tr>
<td>6.</td>
<td>Demonstration of Skull bones</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>i. Cranial bones</td>
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<td></td>
<td>ii. Facial bones</td>
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<td></td>
<td>iii. Fonaemineas &amp; Striation passing through</td>
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<td></td>
<td>iv. Anterior of Skull base</td>
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<td>7.</td>
<td>Demonstration and vertebral columns</td>
<td>4</td>
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<tr>
<td></td>
<td>i. Cervical V</td>
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<td></td>
<td>ii. Thoracic V</td>
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<tr>
<td></td>
<td>iii. Lumbar V</td>
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<tr>
<td></td>
<td>iv. Sacral &amp; Coccyx</td>
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<tr>
<td>8.</td>
<td>Demonstration on ribs or sternum</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>i. A typical rib</td>
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<tr>
<td></td>
<td>ii. Atypical rib</td>
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<tr>
<td></td>
<td>iii. Sternum</td>
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<tr>
<td>9.</td>
<td>Demonstration on bones of upper limb</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>i. Clavicle</td>
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<tr>
<td></td>
<td>ii. Scapula</td>
<td></td>
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<tr>
<td></td>
<td>iii. Humerus</td>
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<td></td>
<td>iv. Radius &amp; Ulna</td>
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<tr>
<td></td>
<td>v. Carpales &amp; Meta carpales</td>
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<tr>
<td>10.</td>
<td>Demonstration on bones of lower limb</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>i. Innominate bone</td>
<td></td>
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<tr>
<td></td>
<td>ii. Femur</td>
<td></td>
</tr>
<tr>
<td></td>
<td>iii. Tibia &amp; Fibula</td>
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<tr>
<td></td>
<td>iv. Tarsals and meta tarsals</td>
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</tr>
<tr>
<td>11.</td>
<td>Demonstration on different joints</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>i. Fibrous joints</td>
<td></td>
</tr>
<tr>
<td></td>
<td>ii. Cartilaginous joints</td>
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<tr>
<td></td>
<td>iii. Synovial joints</td>
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<tr>
<td>12.</td>
<td>Circulatory System</td>
<td>2</td>
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<tr>
<td></td>
<td>Demonstration on heart as a pumping unit</td>
<td></td>
</tr>
<tr>
<td></td>
<td>i. Right atrium</td>
<td></td>
</tr>
<tr>
<td></td>
<td>ii. Left ventricle</td>
<td></td>
</tr>
<tr>
<td></td>
<td>iii. Left atrium</td>
<td></td>
</tr>
<tr>
<td></td>
<td>iv. Left Ventricle</td>
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</tr>
<tr>
<td>13.</td>
<td>Demonstration on different system vessels</td>
<td></td>
</tr>
<tr>
<td></td>
<td>i. Acute &amp; its branches</td>
<td></td>
</tr>
<tr>
<td></td>
<td>ii. Veins &amp; its tributaries</td>
<td></td>
</tr>
</tbody>
</table>
### Respiratory system

<table>
<thead>
<tr>
<th>Demonstration</th>
<th>Count</th>
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</thead>
<tbody>
<tr>
<td>Demonstration on the structure of nasal cavity</td>
<td>1</td>
</tr>
<tr>
<td>Demonstration of structure of larynx &amp; trachea</td>
<td>1</td>
</tr>
<tr>
<td>Demonstration on structure of lung &amp; bronchi</td>
<td>3</td>
</tr>
</tbody>
</table>

### Digestive system

<table>
<thead>
<tr>
<th>Demonstration</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Demonstration on the different parts of oral cavity</td>
<td>1</td>
</tr>
<tr>
<td>Demonstration on oesophagus &amp; stomach</td>
<td>2</td>
</tr>
<tr>
<td>Demonstration on Small intestine large intestine rectum &amp; anal canal</td>
<td>2</td>
</tr>
<tr>
<td>Demonstration on pancreas</td>
<td>1</td>
</tr>
<tr>
<td>Demonstration on liver &amp; gall bladder</td>
<td>2</td>
</tr>
</tbody>
</table>

### Urinary system

<table>
<thead>
<tr>
<th>Demonstration</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Demonstration on the structure of both two kidney</td>
<td>2</td>
</tr>
<tr>
<td>Demonstration on Ureters &amp; Urinary bladder &amp; Urethra</td>
<td>2</td>
</tr>
</tbody>
</table>

### Nervous system

<table>
<thead>
<tr>
<th>Demonstration</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Demonstration on types of nervous</td>
<td>1</td>
</tr>
<tr>
<td>Gross demonstration of different parts of brain</td>
<td>2</td>
</tr>
<tr>
<td>Gross demonstration of spinal cord</td>
<td>2</td>
</tr>
<tr>
<td>Gross demonstration of cranial nerve</td>
<td>2</td>
</tr>
<tr>
<td>Demonstration of Autonomic nerves system</td>
<td>2</td>
</tr>
</tbody>
</table>
## PRACTICAL ACTIVITIES RADIOLOGY

<table>
<thead>
<tr>
<th>S.NO.</th>
<th>Activities</th>
<th>No. of Lab. Periods</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>RADIOLOGY</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.</td>
<td>Introduction, general requirements for radiology</td>
<td>1</td>
</tr>
<tr>
<td>2.</td>
<td>Characteristics of a radiograph regarding its size, shape position, density</td>
<td>2</td>
</tr>
<tr>
<td>3.</td>
<td>Demonstration of radiographic positioning/movements relationship and anatomic terms</td>
<td>4</td>
</tr>
<tr>
<td>4.</td>
<td>Demonstration of different parts of X-Ray medicine &amp; how to clean them</td>
<td>2</td>
</tr>
<tr>
<td>5.</td>
<td>Demonstration of care of cassettes</td>
<td>2</td>
</tr>
<tr>
<td>6.</td>
<td>Demonstration for the uses of aseptic techniques while handling with the patients.</td>
<td>1</td>
</tr>
<tr>
<td>7.</td>
<td>Demonstration for the development of exposed films in the dark room</td>
<td>1</td>
</tr>
<tr>
<td>8.</td>
<td>Demonstration of general body planes/positions/body cavities/division of abdomen</td>
<td>4</td>
</tr>
<tr>
<td>9.</td>
<td>Body demonstration of arterial terms</td>
<td>3</td>
</tr>
<tr>
<td>10.</td>
<td>Radiographic positioning terminology projection /body movements</td>
<td>3</td>
</tr>
<tr>
<td><strong>UPPER EXTREMITY</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11.</td>
<td>Demonstration of different positioning of upper extremity e.g. of hand, wrist, fingers, carpal bones, femur, elbow humours</td>
<td>10</td>
</tr>
<tr>
<td>12.</td>
<td>practical on shoulder projections e.g. axial projection</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>AP, oblique, tangential</td>
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<tr>
<td></td>
<td>Clavicle PA &amp; PA axial views</td>
<td></td>
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<tr>
<td><strong>LOWER EXTREMITY</strong></td>
<td></td>
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<tr>
<td>13.</td>
<td>Demonstration of different positioning of lower extremity e.g. foot, leg, thighs, Foot AP Lateral, medial projections etc.</td>
<td>5</td>
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<tr>
<td>14.</td>
<td>Ankle projections e.g. AP lateral oblique</td>
<td>4</td>
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<tr>
<td>15.</td>
<td>Leg projections e.g. AP lateral oblique</td>
<td>2</td>
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<tr>
<td>16.</td>
<td>Knee projections AP, PA lateral oblique</td>
<td>1</td>
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<tr>
<td>17.</td>
<td>Femur projection AP, Lateral</td>
<td>1</td>
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<tr>
<td>18.</td>
<td>Pelvis &amp; upper femur projection AP lateral</td>
<td>1</td>
</tr>
<tr>
<td>19.</td>
<td>Pelvis &amp; hip joints axial projections, AP lateral PA, oblique views</td>
<td>1</td>
</tr>
</tbody>
</table>
20. Projections for vertebral column e.g. occipital cervical anticalabous (Open mouth) AP projection Cranial, thorax, lumbar & sacral vertebrae.

CHEST
21. Demonstration for positioning of trachea, lung & heart e.g. AP lateral oblique

MOUTH & ABDOMEN
22. Radiographic positioning for parietal and submaxillary glands.
23. Demonstrations for routine procedures & Positions e.g. preparation of patients exposure techniques radiographic projections & radiation projections.

24. Biliary treat
   cholengiography & Cholargiogram
   Procedure/Patient preparation/Preliminary diet/ contraindications

25. Demonstration for contrast studies of gastrointestinal tract e.g. barrium meal & follow through, barrium enema preparation for examining room preparation of patients radiation positioning, exposure term

URINARY SYSTEM
26. Demonstration on urography cystography, contrast used preparation of patient radiologic procedure & protection measure

SKULL
27. Demonstration on lateral projections of cranium patient position central hearing P.A. Projections, AP full basal etc Sella turcica projection
28. projection of nasal bones & para nasal sinuses.

RADIATION PROTECTION
29. Demonstration of different methods & shields used for radiation protection

SPECIAL TECHNIQUES
COMPUTED TOMOGRAPHY
30. Demonstrations for different equipments for tomography
Machine its parts/positioning for tomography for different areas/immobilisation techniques.

31. General rules for Tomography and definition of terms

2

MAMMOGRAPHY

32. Demonstration of different positions/projections/definition of different terms.

2

MYELOGRAPHY

33. Demonstration of different media/preparation of room and patients/positions & projections for this procedure.

2

MAGNETIC RESONANCE IMAGING

34. Demonstration on equipment for MRI/instrument parameters/position for different regions.

ULTRASONOGRAPHY

2
BOOKS RECOMMENDED

1. Physics for radiology students
   By. Dr. M.B. Zafar
   Publisher:- Zafars 273-A-1 Abid Majeed Road, Rawalpindi.

2. First year Physics for radiographer. By. E. Hughes
   Publisher:-E &BS U.K.


5. Merril's allas on radiographic position and radiological procedures Vol.: I,II & III.
<table>
<thead>
<tr>
<th>S.No</th>
<th>Subject</th>
<th>Part / Class</th>
<th>Section</th>
<th>Weightage</th>
<th>Total Marks</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Basic Medical Sciences (Anatomy &amp; Physiology)</td>
<td>XI</td>
<td>I – Cell, Basic Tissue, Lymphatic System, Skin, Special Senses.</td>
<td>33 %</td>
<td>75</td>
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<td></td>
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<td>II – GIT, Respiratory System, Cardiovascular System, Skeletal System &amp; Joints.</td>
<td>33%</td>
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<td>III – Nervous System, Reproductive System, Urinary System, Metabolism.</td>
<td>33%</td>
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<td></td>
<td>Practical</td>
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<td>25</td>
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<td>2</td>
<td>Applied Sciences (Physics &amp; Chemistry)</td>
<td>XI</td>
<td>Physics</td>
<td>50 %</td>
<td>50</td>
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<td>I – (1-4) Science, Measurement, Mechanic &amp; Gravity.</td>
<td>10 %</td>
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<td>II – (5-8) Work &amp; Energy, Machines, Density, Pressure.</td>
<td>10 %</td>
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<td>III – (9-11) Heat, Light &amp; Sound</td>
<td>10 %</td>
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<td>IV – (12-14) Electricity and Magnetism</td>
<td>10 %</td>
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<td>V – (16) Electromagnetic Radiation</td>
<td>50 %</td>
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<td>Chemistry</td>
<td>10 %</td>
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<td>VI – (17- 19) Composition, Reactions, Gas Laws</td>
<td>10 %</td>
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<td>VII – (20-21) Water &amp; Solutions</td>
<td>10 %</td>
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<td>VIII – (22-24) Acid, pH, Electrolytes</td>
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<td>IX – (25-28) Amines, Proteins, Carbohydrates, Lipids.</td>
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<td>III – Films and Dark Room Technique</td>
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## WEIGHTAGE OF VARIOUS SECTION OF THE SYLLABUS

### PART - II

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