

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 to Lt.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.

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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.

(Col. Dr. Azra J. Qureshi)T.I[M]
Principal,
College Of Medical Technology,
Pakistan Institute of Medical Sciences,
Islamabad.

Date:- 12th June,2004.

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.

RADIOGRAPHIC TECHNOLOGY

Name of Subject	Theory / Practical	Topics Included	Marks
Part – I & II			
Basic Medical Sciences	Theory	Anatomy, Physiology, Public Health and First Aid	150
	Practical	As per above subjects through charts and models etc. only for anatomy and physiology	50
Radiographic Techniques	Theory	Special Anatomy, Radiation Physics, Positioning and procedures, Radiology Techniques	150
	Practical	As per above	100
Applied Sciences	Theory	Physics, Chemistry, Computer & Hospital Safety	100
	Practical	Physics, Chemistry related.	50

RADIOGRAPHIC TECHNOLOGY

Name of Subject	Theory / Practical	Topics Included	Marks
Part – I			
Basic Medical Sciences	Theory	Anatomy, Physiology.	75
	Practical	As per above subjects through charts and models etc. only for anatomy and physiology	25
Radiographic Techniques	Theory	Special Anatomy, Radiation Physics. Films and Dark room Techniques	75
	Practical	As per above	50
Applied Sciences	Theory	Physics, Chemistry.	50
	Practical	Physics, Chemistry related.	25

RADIOGRAPHIC TECHNOLOGY

Name of Subject	Theory / Practical	Topics Included	Marks
Part – II			
Basic Medical Sciences	Theory	Public Health and First Aid	75
	Practical	First Aid and Field visits for Public Health	25
Radiographic Techniques	Theory	Positioning and procedures, X-Ray Equipment, Radiology Techniques	75
	Practical	As per above	50
Applied Sciences	Theory	Computer & Hospital Safety	75

RADIOGRAPHIC TECHNOLOGY

PART - I

HOURS DISTRIBUTION PER WEEK

S.No.	Subject	Theory	Practical	Total
1	Radiographic Technique-I	06	06	12
2	Basic Medical Sciences - I	03	03	06
3	Applied Sciences - I	02	01	03
4	English - I	06	-	06
5	Urdu - I	06	-	06
6	Islamic Studies	01	-	01

HOURS DISTRIBUTION PER YEAR

S.No.	Subject	Theory	Practical	Total
1	Radiographic Technique-I	240	240	480
2	Basic Medical Sciences - I	120	120	240
3	Applied Sciences - I	80	40	120
4	English - I	240	-	240
5	Urdu - I	240	-	240
6	Islamic Studies	40	-	40
		960	400	1360

PART- II

HOURS DISTRIBUTION PER WEEK

S.No.	Subject	Theory	Practical	Total
1	Radiographic Technique-II	06	09	15
2	Basic Medical Sciences – II	02	01	03
3	Applied Sciences – II	02	01	03
4	English – II	06	-	06
5	Urdu – II	06	-	06
6	Pak Studies	01	-	01
		23	11	34

HOURS DISTRIBUTION PER YEAR

S.No.	Subject	Theory	Practical	Total
1	Radiographic Technique-II	240	360	600
2	Basic Medical Sciences – II	80	40	120
3	Applied Sciences – II	80	40	120
4	English – II	240	-	240
5	Urdu – II	240	-	240
6	Pak Studies	40	-	40
		920	440	1360

APPLIED SCIENCES

PART - I

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.
3. Mechanics – Force, equation of motion, laws of motion.
4. Gravity – speed, velocity and acceleration, center of gravity, weight and mass.
5. Work, Power, Energy.
6. Simple machines – principles of machines, friction, levers.
7. Density, Specific gravity, Archimedes's Principle.
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.
10. Heat – nature and measurement, effects of heat, methods of transfer.
11. Light – Transmission, reflection and refraction of light, lenses.
12. Sound – How it is produced, characteristic, transmission, reflection of sound, echoes, ultrasound.
13. Electricity – Atomic structure, free electrons, conductor and insulators, Definition of current, P.D., Resistance, Resistance laws, Ohm's law, circuit, series circuit, parallel circuit, Power and energy.
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.
19. Chemical Reactions and Equations.
20. Water – physical and chemical properties, Deliquescent, efflorescent, hygroscopic substances, solvent properties, Hydrolysis, Water cycle, impurities, hard and soft water.
21. Solutions – Terms, Solubility, Concentrations, dilutions, properties of solution.
22. Acid, Bases, and salts.
23. pH Scale and buffer system.
24. Electrolytes and electrolysis.
25. Amines and amides
26. Proteins – compositions, properties of amino acids, classifications.
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 H_2SO_4 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 SCIENCES
PART – II

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 over view of Computer system.
2. The shapes of computer today–Super Computer, Main frame, mini computer, Works stations and PC.
3. Input methods–Key board , Mouse,
4. Alter native methods of input – hand devices, optical devices, Audio-visual input devices.
5. Monitors and sound system – Monitors – PC. Projectors, sound system.
6. Printer and brief introduction to its types.
7. Transforming data in to information representation, process, speed etc.
8. CPU – types with definition
9. Types of storage devices – Magnetic and optical.
10. Measuring drive information- access time, file compression, transfer rate, interface standard.
11. Basic of operating system–interface, programme, files, hardware and software management
12. Definitions of Unix, DOS, Macintosh operating system, Windows, OS / 2, Windows NT, 95, 98, 2000, Linux.
13. Words processing and Desk tope Publishing software.
14. Spread sheet software.
15. Presentation programme
16. Data base management System.
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.
22. Graphics software.
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 microorganisms
- 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.

Week	Contents
1. Introduction	
2-3.	The study of human cell and functions of organelles, Nucleus, DNA helix, RNA, genetic code, Chromosomes. Cell Division Mitosis and Meiosis of cell
4-9.	BASIC TISSUES <ul style="list-style-type: none">- 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 <ul style="list-style-type: none">- Mouth- Pharynx- Esophagus- Stomach- Small Intestine- Large Intestine- Accessory organs (Liver, Spleen, Pancreas & Gall Bladder)
18-20.	Respiratory System <ol style="list-style-type: none">1. Organs of respiration2. Upper respiratory tract3. Lower respiratory tract
21-22.	The Skin <ul style="list-style-type: none">- 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 Endo Crine 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:

Foundations of anatomy and physiology by Kathleen J.W. Wilson.

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.

27-28. Endocrine Glands.

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 (Haematologic) 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 crowding and its effects on human body. Natural ventilation and artificial ventilation.

18-25. Wastage

Introduction-refuse and its collection. Methods of collection and disposal of refuse-Excreta-Methods of collection and disposal of Excreta.

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.
6. Electric introduction-electroscopes.
7. Electric charge and electrical potential.
8. Capacitance and capacitors.
9. Electric current-ampere, volt, resistance.
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.
18. Electro-magnetic induction.
19. Mutual induction and self-induction.
20. Introduction of A.C.
21. Transformer-theory.
22. Transformer-practical aspects.
23. Introduction A.C. circuits.
24. Reactance, resonance, impedance.
25. Power factor-power in single-phase circuit.
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.
31. Generator-A.C. & D.C. Principle, working-main parts.
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.
39. Rectification.
40. Introduction to amplification.

RADIATION PHYSICS

1. Structure of atom, definitions of terms.
2. Electromagnetic Radiation theory and properties.
3. Wave theory and Quantum theory of Radiation.
4. Visible light and fluorescence.
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.
10. Principle of x-rays tubes.
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.
21. Interaction of x and gamma rays with matter.
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.
4. Methods of storage of films.
5. Introduction to fluorescence Fluorescent materials.
6. Purpose and methods of using fluorescent screen intensifying screens.
7. Physical construction of screens, cassettes and film holders.
8. Intensification factors.
9. Screens for multi-section tomography.
10. Care and safety of screens and x-rays cassettes.
11. Variation of films and screens with patients thickness and an anatomical structure.
12. Focal film distance, speed of films, speed of screens.
13. Methods of film labeling and identification, sizes etc.
14. Chemicals used in film development.
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.

RADIOGRAPHIC TECHNIQUES

PART - II

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.
9. Bones of thorax-positions and procedures for x-ray.
10. Bones of neck and their positions.
- 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.
- 15-16. Skull-face, salivary glands, paranasal sinuses, their positions, procedure adopted.
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.
25. Conventional Tomography- Its principles & techniques.
26. Introduction to C.T.Scan
27. Isotope scanning-theory and practice.
28. Magnetic Resonance Imaging (MRI) - Introduction, CT scan, vis-à-vis Brain / Spinal Cord.
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-Millamperes 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.
6. Anatomy of Thorax.
7. Anatomy of Neck.
8. Anatomy of digestive system
9. Anatomy of urinary system.
10. Anatomy of male and female reproductive system.
- 11.14. Anatomy of skull, face, salivary glands & paranasal sinuses
15. Anatomy of ear, Mastoid & temporal bone.

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

14. Respiratory system	1
Demonstration on the structure of nasal cavity	
15. Demonstration of structure of larynx & trachea	1
16. Demonstration on structure of lung & bronchi	3
17. Digestive system	1
Demonstration on the different parts of oval cavity	
18. Demonstration on oesophagus & stomach	2
19. Demonstration on Small intestine large intestine rectum and anal canal	2
20. Demonstration on pancreas	1
21. Demonstration on liver & gall bladder	2
 Urinary system	
22. Demonstration on the structure of both two kidney	2
23. Demonstration on Ureters & Urinary bladder & Urethra	2
24. Nervous system	1
Demonstration on types of nervous	
25. Gross demonstration of different parts of brain	2
26. Gross demonstration of spinal card	2
27. Gross demonstration of cranial nerve	2
28. Demonstration of Autonomic nerves system	2

PRACTICAL ACTIVITIES RADIOLOGY

S.NO.	Activities	No. of Lab. Periods
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RADIOLOGY

1.	Introduction, general requirements for radiology	1
2.	Characteristics of a radiograph regarding its size, shape position, density.	2
3.	Demonstration of radiographic positioning/movements relationship and anatomic terms	4
4.	Demonstration of different parts of X-Ray medicine & how to clean them	2
5.	Demonstration of care of cassettes	2
6.	Demonstration for the uses of aseptic techniques while handling with the patients.	1
7.	Demonstration for the development of exposed films in the dark room	1
8.	Demonstration of general body planes/positions/body cavities/division of abdomen	4
9.	Body demonstration of arterial terms	3
10.	Radiographic positioning terminology projection terminology /body movements	3

UPPER EXTREMITY

11.	Demonstration of different positioning of upper extremity e.g. of hand, wrist, fingers, carpal bones, femur, elbow humours	10
12.	practical on shoulder projections e.g. axial projection AP, oblique, tangential Clavicle PA & PA axial views	5

LOWER EXTREMITY

13.	Demonstration of different positioning of lower extremity e.g. foot, leg, thighs, Foot AP Lateral, medial projections etc.	5
14.	Ankle projections e.g. AP lateral oblique	4
15.	Leg projections e.g. AP lateral oblique	2
16.	Knee projections AP, PA lateral oblique	1
17.	Femur projection AP, Lateral	1
18.	Pelvis & upper femur projection AP lateral	1
19.	Pelvis & hip joints axial projections, AP lateral PA, oblique views	1

20. Projections for vertebral column e.g. occipital cervical anticubous (Open mouth)AP projection Cranial , thorax, lumbar & sacral vertebrae. 5

CHEST

21. Demonstration for positioning of trachea, lung & heart e.g. AP lateral oblique 5

MOUTH & ABDOMEN

22. Radiographic positioning for parietal and submaxillary glands. 1

23. Demonstrations for routine procedures & Positions e.g. preparation of patients exposure techniques radiographic projections & radiation projections. 5

24. Biliary treat 3
 cholengiography&
 Cholargiogram
 Procedure/Patient preparation/Preliminary diet/
 contraindications

25. Demonstration for contrast studies of gastrointestinal tract e.g. barriun meal & follow through, barrium enema preparation for examining room preparation of patients radiation positioning, exposure term 6

URINARY SYSTEM

26. Demonstration on urography cystography, contrast used preparation of patient radiologic procedure & protection measure 5

SKULL

27. Demonstration on lateral projections of cranium patient position/central hearing P.A. Projections, AP full basal etc Sella turcica projection 5
 1

28. projection of nasal bones & para nasal sinuses. 3

RADIATION PROTECTION

29. Demonstration of different methods & shields used for radiation protection 2

SPECIAL TECHNIQUES

COMPUTED TOMOGRAPHY

30. Demonstrations for different equipments for tomography 5

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
MEGNETIC RESONANCE IMAGING	
34. Demonstration on equipment for MRI/instrument parameters/position for different regions.	2
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.
3. X-Ray equipment for student radiographers. By. DN & MO Chesney.
Publishers: Black scientific publication Oxford London.
4. Medical X-ray Techniques in diagnostic radiology. By: Ploat Publishers: Macmillan Press London.
5. Merrill's atlas on radiographic position and radiological procedures Vol.: I,II & III.
By. Phillip.W.Belliager. Publisher:- C.V. Mosby company st: Louis, Toronto & Preston.

WEIGHTAGE OF VARIOUS SECTION OF THE SYLLABUS

PART - I

S.No	Subject	Part / Class	Section	Weightage	Total Marks
1	Basic Medical Sciences (Anatomy & Physiology)	XI	I – Cell, Basic Tissue, Lymphatic System, Skin, Special Senses. II – GIT, Respiratory System, Cardiovascular System, Skeletal System & Joints. III – Nervous System, Reproductive System, Urinary System, Metabolism.	33 % 33% 33%	75
	Practical				25
2	Applied Sciences (Physics & Chemistry)	XI	Physics I – (1-4) Science, Measurement, Mechanic & Gravity. II – (5-8) Work & Energy, Machines, Density, Pressure. III – (9-11) Heat, Light & Sound IV – (12-14) Electricity and Magnetism V – (16) Electromagnetic Radiation Chemistry VI – (17- 19) Composition, Reactions, Gas Laws VII – (20-21) Water & Solutions VIII – (22-24) Acid, pH, Electrolytes IX – (25-28) Amines, Proteins, Carbohydrates, Lipids.	50 % 10 % 10 % 10 % 10 % 10 % 50 % 10 % 10 % 10 % 10 % 10 % 10 % 10 %	50
	Practical		As per list given		25
3	Radiographic Techniques - I	XI	I – Electromagnetism II – Radiation Physics III – Films and Dark Room Technique	33 % 33% 33%	75
	Practical		Sme as above		50
4	English	XI	As per approved syllabus for HSSC – I		100
5	Urdu		As per approved syllabus for HSSC – I		100
6	Islamiyat		As per approved syllabus for HSSC – I		50

WEIGHTAGE OF VARIOUS SECTION OF THE SYLLABUS

PART - II

S.No	Subject	Part / Class	Section	Weightage	Total Marks
1	Basic Medical Sciences (First Aid & Public Health)	XII	I – Topic 1, 2, 33 – 37 (First Aid), Topic 1 & 2 (Public Health) II – FA Topics 7 – 15, 18, 21 – PH Topics 3 – 17 & 40 III – FA Topics 17, 20, 22, 23, & 32 -- PH Topics 18 -27 IV – FA Topics 24 –26, 29 – 31 – PH 30 – 39	25 % 25% 25% 25%	75
	Practical		Same as above		25
2	Applied Sciences (Computer & Patient Safety)	XII	Computer I – Topics 1- 6 II – Topics 7 - 12 III – Topics 13 – 18 IV – Topics 19 – 24 V – Topics 25 – 30 Patient Safety VI – Electrical Safety VII – Fire and Explosion VIII – Surgical Diathermy IX – Radiation Safety X – Infection in Hospital	50 % 10 % 10 % 10 % 10 % 50 % 20 % 02 % 08 % 15 % 05%	75
3	Radiographic Techniques - II	XII	I – Radiological Anatomy II – X-Ray Equipment III – Positioning and Procedures	33% 33% 33%	75
	Practical		Same as above		50
4	English	XII	As per approved syllabus for HSSC – I		100
5	Urdu	XII	As per approved syllabus for HSSC – I		100
6	Pak Study	XII	As per approved syllabus for HSSC – I		50