4 YEARS DEGREE PROGRAMME

IN

MEDICAL IMAGING TECHNOLOGY

BSc. (HONS.)

2017

RAWALPINDI MEDICAL UNIVERSITY, RAWALPINDI, PAKISTAN

NOMENCLATURE:

The name of the degree program shall be B.Sc. Medical Imaging Technology. The duration of the course shall be 4 years with structured training in a recognized department under an approved supervisor.

COURSE TITLE:

B.Sc. (Honors) Medical Imaging Technology

TRAINING CENTERS:

Radiology units of the hospitals accredited by RMU for the training of students of affiliated institutes.

COURSE DIRECTORS:

Course Directors are experts appointed to execute Medical Imaging Technology Course at affiliated Institutions in approval/consultation with RMU (Experienced Technologists with or without Qualifications in educations.

DOCUMENTS REQUIRED FOR ADMISSION:

- Completed B.Sc. (Hons) Medical Imaging Technology application form
- Copy of the Matriculation Certificate
- Copy of the F.Sc / Equivalent Examination Certificate with detailed marks sheet
- 3 passport size photographs

REGISTRATION AND ENROLLMENT:

- Total number of students enrolled as permitted by RMU.
- RMU will approve Course Directors/supervisors for the course.

AIMS AND OBJECTIVES OF THE COURSE

AIMS:

The aim of the 4 years degree program in Medical Imaging Technology is to equip the students with relevant professional knowledge, skills, techniques and ethical values to enable them to apply their acquired expertise according to the scope of profession for efficient health service delivery.

GENERAL LEARNING OUTCOMES

Medical Imaging Technology education and training should enable the student to:

- Develop accuracy and meticulousness to attain high levels of ethics and technical proficiency.
- Assess the technical and nontechnical skills in a standardized and reproducible environment.
- Strengthen the decision power and exercise appropriate judgment skills, to be applied especially during crisis.
- Develop good leadership, problem solving and administrative skills.
- Develop and analyze innovative strategies for effective communication with the patients and the healthcare personnel.
- Demonstrate interdisciplinary team building strategies for effective co-ordination between various Allied Health Disciplines.
- Demonstrate understanding of the basic concepts of professional behavior and legal implications of the work environment.
- Demonstrate the knowledge of his / her role in health care delivery system.
- Establish and maintain continuing education as a function of growth and maintenance of professional competence.

SPECIFIC LEARNING OUTCOMES

The MIT is the expert in integrating seven areas of key importance in the imaging departments. The seven areas include patient care, use of technology, optimization of dose, clinical responsibility, organization, quality assurance and education and training. The student should be proficient to:
Competency statements:

1. **Patient Care**
   a) Perform proper identification of the patient
   b) Ensure that the patient gives or has given informed constant having first given the patient a clear explanation of the procedure to ensure his cooperation.
   c) Meet ethical/moral considerations
   d) Ensure that no previously performed imaging procedure has already provided the information requested.
   e) Ensure that a relevant clinical history has been obtained

f) Ensure that no concurrent treatment or investigation will prevent a good result
g) Ensure that any preparatory instructions, pre medications or contrast media have been administered correctly
h) Ensure that an appropriate check regarding pregnancy has been performed and that appropriate action has been taken
i) Consider the radiation protection status of the patient
j) Perform appropriate after-care
k) Use appropriate facilities and methods to prevent cross infection with particular emphasis on precaution standards for blood borne pathogens, specifically HIV and hepatitis.
l) Evaluate the patient's condition prior to the examination in order to make judgment as to the best method to use.
m) Initiate basic life-support methods if necessary.
n) React appropriately to other emergency situations
o) Give intravenous injections for the purpose of imaging provided that the appropriate training and authorization has been given.

2. **Use of Imaging Technology**

a) Make a judgment as to the purpose of the request and take the correct action.
b) Position the patient, source of radiation, image recording device and any ancillary equipment such that the final image is optimum.
c) Make a judgment as to necessary adaptations to departmental protocols and take appropriate action.
d) Use the equipment safely and correctly
e) Ensure that any error in the final image is not due to incorrect usage of equipment.
f) Select suitable combinations of exposure factors and image recording materials to produce optimum images allowing for the patient's conditions.
g) Maintain and control all the steps involved in the production and storage of a permanent of visible image.
h) Assess the resultant image for suitability for its purpose.

Where digital imaging is involved, in addition to the previously stated elements, the MRT must be competent to:

i) Apply a detailed knowledge of anatomy in different sectional planes in order to be able to correlate the position of the patient with the require three dimensional information.
j) Select programs.
k) Give advice as to the likely quality of the image using the parameters selected e.g. use of compensating filters, timing of injection, selection of exposure factors etc.
l) Record, adapt and reconstruct data to obtain optimum image quality.

m) Store and retrieve information.
n) Assess the resultant images for suitability for interpretation and diagnosis.

3. Optimization of dose

a) Select and manipulate the exposure factors and image recording materials such that the dose to the patient is minimized whilst giving the optimum image.
b) Ensure that all equipment to be used us fully fit for its purpose.
c) Use all equipment and methods in order to ensure minimization of dose to patient, staff and public and to ensure that no person receives unnecessary irradiation.
d) Ensure that any protocols relating to the imaging of patients of childbearing capability are applied.
e) Fulfill any requirements for the recording of dose.
f) Take appropriate action in radiological emergency situations.

4. Clinical Responsibility

a) Be professionally accountable for his actions.
b) Make judgments as to his professional limitations and take appropriate action.
c) Maintain confidentiality of information.

5. Organization

a) Efficiently organize the performance of an individual examination.
b) Efficiently organize work within the area for which he is responsible.
c) Ensure compliance with all applicable legislation relating to his work.

6. Quality Assurance

The MIT must be competent in assessing the quality of his work.
Regard should be given to each of the headings above (1 - 6)

7. Education and Training

The MIT must be competent to share his knowledge and clinical experience with the students of MIT program in a professional manner.

SCHEME OF STUDIES/TRAINING:

The training is spread over four years with a specific component for each year of training.

FIRST YEAR:

Theoretical Component:

- Regional & Imaging Anatomy I
- Basic Physiology

- Basic Biochemistry
- General Pathology
- Behavioral Sciences
- Islamic studies/Ethics
- Pakistan Studies
- Computer Education

Practical component:
Hand- on training in basic imaging techniques in the Departments of Radiology

SECOND YEAR:
Theoretical component:

- Regional & Imaging Anatomy II
- Radiation Sciences & Technology
- General Radiology
- Mammography & Special Radiological Techniques
- Clinical Pharmacology

Practical Component:
Hands-on training in Radiography and other above mentioned disciplines, and

THIRD YEAR:
Theoretical Component:

- Ultrasound & Echocardiography
- Computed Tomography (CT)
- Medical Sociology
- Medicine
- Surgery

Practical Component:
Hands-on rotational training in above mentioned disciplines in the Departments of Radiology, Medicine and Surgery.

FOURTH YEAR:
Theoretical Component:

- Nuclear Medicine
- Angiography & Cardiac Imaging
- Magnetic Resonance Imaging
- Research and Biostatistics

- ***Practical Component:***

Advanced training in Department of Radiology and Cardiology related to above mentioned disciplines.

Research Report related to the subject of interest of the student.

RECOGNITION / EQUIVALENCE OF THE DEGREE AND THEINSTITUTION

After four years training and education, the candidates on successful completion of the course will be awarded a graduate degree in Medical Imaging technology by the RMU, equivalent to any other similar qualifications.

METHODS OF INSTRUCTION

- Large group teachings (lectures)
- Discussion
- Seminar presentations
- Assignments
- Skills teachings/Labs
- Clinical Rotations
- Self-Learning.

ASSESSMENT:

INTERNAL ASSESSMENT BY THE FACULTY:

Formative Assessment will be helpful to improve the existing instructional methods. This will be carried out through a predesigned form filled in by Head of Program/Course Director.

- Punctuality
- Practical work
- Regularity conducted class tests

SUMMATIVE ASSESSMENT:

It will be carried out by RMU at the end of the program to empirically evaluate the cognitive, psychomotor and the affective domains in order to award the degree after successful completion of the course.

EQUIPMENTS AND GADGETS

Following Items/Equipment's are required for MIT training

Well-equipped and properly lighted separate rooms for the X-Ray, Fluoroscopy, Mammography, Ultrasound, CT scan, MRI, Nuclear Medicine, Cath. lab.

- General screening Unit
- Plain X Rays
- Portable X-Ray Equipment
- Mammography X-Ray machine
- Ultrasound Machine
- Portable Ultra sound machine
- CT Equipment
- Laser Cameras
- MRI Equipment
- Fluoroscopes
- Angiography catheters and equipment's
- C.Arm Image Intensifier
- C-ARMS / C-ARM Tables
- Accident and Emergency X-ray unit especially designed for Emergency and Accident patients
- Dry Laser Printer
- Simple and Automatic X-Ray Film Processor unit
- Bone Densitometer
- Transducers
- Color Doppler unit
- Whole Body Spiral C.T. Scan unit with Dry View Processor
- Dose Calibrator
- Thyroid uptake system
- Intra Operative Gamma Surgical Probe
- Gamma Counter for Radio-Immune-Assay
- Stress Test System.
- Shielding devices for the personnel protection and other equipment's as required.

Annex: A

First Professional B.Sc. (HONS) Medical Imaging Technology

Total Marks = 600

PAPER-I **SUBJECTS**

Paper-I Regional & Imaging Anatomy I

Theory	90 Marks
Oral& Practical	90 Marks
Internal Assessment	20 Marks
	Total Marks=200

Paper-II Basic Physiology

Theory	90 Marks
Internal Assessment	10 Marks
	Total Marks=100

Paper-III Basic Biochemistry & General Pathology

Theory	90 Marks
Internal Assessment	10 Marks
	Total Marks=100

Paper-IV Islamic Studies / Ethics & Pakistan Studies

Theory	100 Marks
Islamic Studies/Ethics	60 Marks
Pakistan Studies	40 Marks
	Total Marks=100

Paper-V Behavioral Sciences & Computer Education

Theory	90 Marks
Internal Assessment	10 Marks
	Total Marks=100

FIRST PROFESSIONAL EXAMINATION

OUTLINE OF TESTS

The First Professional examination shall be held at the end of first academic year and every candidate shall be required to take examination in the following subjects.

Paper-I: Regional & Imaging Anatomy

Theory **Marks:** 100

The intention of this Examination in the subject of Regional and Imaging Anatomy is to assess the knowledge and cognitive skills underlying the intelligent performance of the tasks typically required of technologist at entry level into the profession. The examination in this subject shall consist of one theory paper of three hours duration and of maximum 90 marks. Internal assessment shall be of 10 Marks. The syllabus to be covered is mentioned in Appendix "B". There will be 09 short essay questions from this subject and there will be no choice. Each short essay question will carry 05 marks. There will be 45 MCQs and each question will carry 01 mark.

Oral & Practical **Marks: 100**

This exam shall consist of two parts: Part one OSPE shall be set by RMU with Key. Part Two Viva Marks, which shall be equally divided into internal and external Examiners.
Marks distribution: 20 Marks OPSE, 30 Marks internal examiner Viva, 30 external examiner Viva and 10 marks of log book. Internal Assessment shall be of 10 Marks.

Paper-II: Basic Physiology Marks: 100

The examination in the subject of Basic Physiology shall consist of one Theory Paper of three hours duration and of maximum 90 marks. Internal Assessment will be of 10 marks. The syllabus to be covered is mentioned in Appendix “B”.

There will be 45 MCQs and 9 SAQs. Each short essay question will carry 05 marks. There will be 45 MCQs and each question will carry 01 mark.

Paper-III: Basic Biochemistry & General Pathology Marks: 100

The examination in the subject of Basic Biochemistry & General Pathology shall consist of one Theory Paper of three hours duration and of maximum 90 marks. Internal Assessment will be of 10 marks. There will be two sections in this paper.

Section – I: Basic Biochemistry = 50 marks

There will be 45 MCQs and each question will carry 01 mark.
Internal Assessment will be of 05 marks.

Section – II: General Pathology = 50marks

There will be 45 MCQs and each question will carry 01 mark. Internal Assessment will be of 05 marks.

Paper-IV: Islamic Studies / Ethics & Pakistan Studies Marks: 100

The examination shall consist of one Theory Paper of 60+40=100 marks and 3 hours duration. The syllabus to be covered is mentioned in Appendix "B".

Section-I: Islamic Studies/Ethics =60 marks.

This section shall have question on Islamic Studies in case Muslim candidates and on Ethics in case of non-Muslim. There shall be 3 questions in this section of Theory and there will be no choice. Each question shall carry 20 marks.

Section-II: Pakistan Studies = 40 marks

This section shall have 2 questions on Pakistan Studies and there will be no choice. Each question shall carry 20 marks.

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Paper-V: Behavioral Sciences & Computer Education Marks: 100

The examination in the paper of Behavioral Sciences& Computer Education shall consist of one Theory Paper of 90 marks and three hours duration. Internal Assessment will be of 10 marks. The syllabus to be covered is mentioned in Appendix "B".

Section I: Behavioral Sciences = 50 marks

There will be 45 MCQs and each question will carry 01 mark.
Internal Assessment will be of 05 marks.

Section – II: Computer Education = 50 marks

There will be 45 MCQs and each question will carry 01 mark Internal Assessment will be of 05 marks.

Second Professional B.Sc. Medical Imaging Technology

Total Marks = 950

Paper I Regional & Imaging Anatomy

Theory	90 Marks
Oral& Practical	90 Marks
Internal Assessment	20 Marks
	Total Marks=200

Paper II Radiation Sciences & Technology

Theory	90 Marks
Oral& Practical	90 Marks
Internal Assessment	20 Marks
	Total Marks=200

Paper III General Radiology

Theory	90 Marks
Oral& Practical	90 Marks
Internal Assessment	20 Marks
	Total Marks=200

Paper IV Mammography & Special Radiological Techniques

Theory	90 Marks
Oral & Practical	90 Marks
Internal Assessment	20 Marks
	Total Marks=200

Paper V Clinical Pharmacology

Theory	90 Marks
Oral& Practical	45 Marks
Internal Assessment	15 Marks
	Total Marks=150

SECOND PROFESSIONAL EXAMINATION

OUTLINE OF TESTS

Total marks: 950

The Second Professional Examination shall be held at the end of second year and shall consist of the following subjects:

Paper-I: Regional & Imaging Anatomy

Theory **Marks: 100**

The intention of this Examination in the subject of Regional and Imaging Anatomy is to assess the knowledge and cognitive skills underlying the intelligent performance of the tasks typically required of technologist at entry level into the profession. The examination in this subject shall consist of one theory paper of three hours duration and of maximum 90 marks. Internal assessment shall be of 10 Marks. The syllabus to be covered is mentioned in Appendix "B". There will be 09 short essay questions from this subject and there will be no choice. Each short essay question will carry 05 marks. There will be 45 MCQs and each question will carry 01 mark.

Oral & Practical **Marks: 100**

This exam shall consist of two parts: Part one OSPE shall be set by RMU with Key. Part Two Viva Marks, which shall be equally divided in to internal and external Examiners.
Marks distribution: 20 Marks OPSE, 30 Marks internal examiner Viva, 30 external examiner Viva and 10 marks of log book. Internal Assessment shall be of 10 Marks.

Paper-II: Radiation Science & Technology

Theory **Marks: 100**

The intention of this Examination in the subject of Radiation Science & Technology is to assess the knowledge and cognitive skills underlying the intelligent performance of the tasks typically required of technologist at entry level into the profession. The examination in this subject shall consist of one Theory Paper of three hours duration and of maximum 90 marks. Internal assessment shall be of 10 Marks. The syllabus to be covered is mentioned in Appendix "B". There will be 09 short essay questions from this subject and there will be no choice. Each short essay question will carry 05 marks.
There will be 45 MCQs and each question will carry 01 mark.

Oral & Practical **Marks: 100**

This exam shall consist of two parts: Part one OSPE shall be set by RMU, Key shall be provided. Part Two Viva which shall be equally divided in to internal and external. Marks distribution: 20

Marks OPSE, 35 Marks internal examiner Viva, 35 external examiner Viva. Internal Assessment shall be of 10 Marks.

Paper-III: General Radiology

Theory **Marks: 100**

The intention of this Examination in the subject of General Radiology is to assess the knowledge and cognitive skills underlying the intelligent performance of the tasks typically required of technologist at entry level into the profession. The examination in this subject shall consist of one Theory Paper of three hours duration and of maximum 90 marks. Internal assessment shall be of 10 Marks. The syllabus to be covered is mentioned in Appendix "B". There will be 09 short essay questions from this subject and there will be no choice. Each short essay question will carry 05 marks. There will be 45 MCQs and each question will carry 01 mark.

Oral & Practical **Marks: 100**

This exam shall consist of two parts: Part one OSPE shall be set by RMU, Key shall be provided. Part Two Viva which shall be equally divided in to internal and external. Marks distribution: 20 Marks OPSE, 30 Marks internal examiner Viva, 30 external examiner Viva and 10 marks of log book. Internal Assessment shall be of 10 Marks.

Paper-IV: Mammography & Special Radiological Techniques

Theory **Marks: 100**

The intention of this Examination in the subject of Mammography & Special Radiological Techniques is to assess the knowledge and cognitive skills underlying the intelligent performance of the tasks typically required of technologist at entry level into the profession. The examination in this subject shall consist of one Theory Paper of three hours duration and of maximum 90 marks. Internal assessment shall be of 10 Marks. The syllabus to be covered is mentioned in Appendix "B". There will be 09 short essay questions from this subject and there will be no choice. Each short essay question will carry 05 marks. There will be 45 MCQs and each question will carry 01 mark.

Oral & Practical **Marks: 100**

This exam shall consist of two parts: Part one OSPE shall be set by RMU, Key shall be provided. Part Two Viva which shall be equally divided in to internal and external. Marks distribution; 20 Marks OPSE, 30 Marks internal examiner Viva, 30 external examiner Viva and 10 marks of log book. Internal Assessment shall be of 10 Marks.

Paper V: Clinical Pharmacology

Theory **Marks: 100**

The intention of this Examination in the subject Clinical Pharmacology is to assess the knowledge and cognitive skills underlying the intelligent performance of the tasks typically required of technologist at entry level into the profession. The examination in this subject shall consist of one

Theory Paper of three hours duration and of maximum 90 marks. Internal assessment shall be of 10 Marks. The syllabus to be covered is mentioned in Appendix "B". There will be 09 short essay questions from this subject and there will be no choice. Each short essay question will carry 05 marks.
There will be 45 MCQs and each question will carry 01 mark.

Oral & Practical **Marks:** 50

Viva shall be equally divided in to internal and external. Marks distribution: 20 Marks internal examiner Viva, 20 external examiners Viva. Internal Assessment shall be of 5 Marks.

Third Professional B.Sc. Medical Imaging Technology Examination

Total Marks = 800

Paper I **Ultrasound & Echocardiography**

Theory	90 Marks
Oral & Practical	90 Marks
Internal Assessment	20 Marks
	Total Marks=200

Paper II **Computed Tomography (CT)**

Theory	90 Marks
Oral & Practical	90 Marks
Internal Assessment	20 Marks
	Total Marks=200

Paper III **Medical Sociology**

Theory	90Marks
Internal Assessment	10 Marks
	Total Marks=100

Paper –IV **Surgery**

Theory	90 Marks
Internal Assessment	10 Marks
	Total Marks=100

Paper V **Medicine**

Theory	90 Marks
Oral & Practical	90 Marks
Internal Assessment	20 Marks
	Total marks 200

THIRD PROFESSIONAL EXAMINATION
OUTLINE OF TESTS

Total marks: 800

The Third Professional Examination shall be held at the end of third year and shall consist of the following subjects:

Paper I: Ultrasound & Echocardiography

Theory **Marks: 100**

The intention of this Examination in the subject of Ultrasound & Echocardiography is to assess the knowledge and cognitive skills underlying the intelligent performance of the tasks typically required of technologist at entry level into the profession. The examination in this subject shall consist of one Theory Paper of three hours duration and of maximum 90 marks. Internal assessment shall be of 10 Marks. The syllabus to be covered is mentioned in Appendix "B". There will be 09 short essay questions from this subject and there will be no choice. Each short essay question will carry 05 marks.
There will be 45 MCQs and each question will carry 01 mark.

Oral & Practical **Marks: 100**

This exam shall consist of two parts: Part one OSPE shall be set by RMU, Key shall be provided. Part Two Viva which shall be equally divided in to internal and external. Marks distribution: 20 Marks OPSE, 30 Marks internal examiner Viva, 30 external examiner Viva and 10 marks of log book. Internal Assessment shall be of 10 Marks.

Paper- II: Computed Tomography (CT)

Theory **Marks: 100**

The intention of this Examination in the subject of Computed Tomography is to assess the knowledge and cognitive skills underlying the intelligent performance of the tasks typically required of technologist at entry level into the profession. The examination in this subject shall consist of one Theory Paper of three hours duration and of maximum 90 marks. Internal assessment shall be of 10 Marks. The syllabus to be covered is mentioned in Appendix "B". There will be 09 short essay questions from this subject and there will be no choice. Each short essay question will carry 05 marks.
There will be 45 MCQs and each question will carry 01 mark.

Oral & Practical **Marks: 100**

This exam shall consist of two parts: Part one OSPE shall be set by RMU, Key shall be provided. Part Two Viva which shall be equally divided in to internal and external. Marks distribution: 20 Marks OPSE, 30 Marks internal examiner Viva, 30 external examiner Viva and 10 marks of log book. Internal Assessment shall be of 10 Marks.

Paper -III: Medical Sociology

Theory **Marks: 100**

The examination in this subject shall consist of one Theory Paper of three hours duration and of maximum 90 marks. Internal assessment shall be of 10 Marks. The syllabus to be covered is mentioned in Appendix "B". There will be 09 short essay questions from this subject and there will be no choice. Each short essay question will carry 05 marks. There will be 45 MCQs and each question will carry 01 mark. Internal Assessment shall be of 10 Marks

Paper –IV: Surgery

Theory **Marks: 100**

The examination in this subject shall consist of one Theory Paper of three hours duration and of maximum 90 marks. Internal assessment shall be of 10 Marks. The syllabus to be covered is mentioned in Appendix "B". There will be 09 short essay questions from this subject and there will be no choice. Each short essay question will carry 05 marks. There will be 45 MCQs and each question will carry 01 mark.

Paper-V: Medicine

Theory **Marks: 100**

The intention of this Examination in the subject of Medicine is to assess the knowledge and cognitive skills underlying the intelligent performance of the tasks typically required of technologist at entry level into the profession. The examination in this subject shall consist of one Theory Paper of three hours duration and of maximum 90 marks. Internal assessment shall be of 10 Marks. The syllabus to be covered is mentioned in Appendix "B". There will be 09 short essay questions from this subject and there will be no choice. Each short essay question will carry 05 marks. There will be 45 MCQs and each question will carry 01 mark.

Oral & Practical (Basic Patient Care): **Marks: 100**

This exam shall consist of two parts: Part one OSPE shall be set by RMU, Key shall be provided. Part Two Viva which shall be equally divided in to internal and external. Marks distribution: 20 Marks OPSE, 35 Marks internal examiner Viva, 35 external examiner Viva. Internal Assessment shall be of 10 Marks.

Final Professional B.Sc. Medical Imaging Technology

Total Marks = 700

Paper I **Nuclear Medicine**

Theory	90 Marks
Oral & Practical	90 Marks
Internal Assessment	20 Marks
	Total Marks=200

Paper II **Angiography & Cardiac Imaging**

Theory	90 Marks
Oral & Practical	90 Marks
Internal Assessment	20 Marks
	Total Marks=200

Paper III **Magnetic Resonance Imaging**

Theory	90 Marks
Oral & Practical	90 Marks
Internal Assessment	10 Marks
	Total Marks=200

Paper IV **Biostatistics & Research Methods**

Theory	45 Marks
Oral & Practical	45 Marks
Internal Assessment	10 Marks
	Total marks= 100

FINAL PROFESSIONAL EXAMINATION

OUTLINE OF TESTS

Total marks: 700

The Final Professional Examination shall be held at the end of fourth year and shall consist of the following subjects:

Paper I Nuclear Medicine

Theory **Marks: 100**

The intention of this Examination in the subject of Nuclear Medicine is to assess the knowledge and cognitive skills underlying the intelligent performance of the tasks typically required of technologist at entry level into the profession. The examination in this subject shall consist of one Theory Paper of three hours duration and of maximum 90 marks. Internal assessment shall be of 10 Marks. The syllabus to be covered is mentioned in Appendix "B". There will be 09 short essay questions from this subject and there will be no choice. Each short essay question will carry 05 marks. There will be 45 MCQs and each question will carry 01 mark.

Oral & Practical **Marks: 100**

This exam shall consist of two parts: Part one OSPE shall be set by RMU, Key shall be provided. Part Two Viva which shall be equally divided in to internal and external. Marks distribution: 20 Marks for OPSE, 30 Marks internal examiner Viva, 30 external examiner Viva and 10 marks of log book. Internal Assessment shall be of 10 Marks.

Paper II Angiography and Cardiac Imaging

Theory **Marks: 100**

The intention of this Examination in the subject of Angiography and Cardiac Imaging is to assess the knowledge and cognitive skills underlying the intelligent performance of the tasks typically required of technologist at entry level into the profession. The examination in this subject shall consist of one Theory Paper of three hours duration and of maximum 90 marks. Internal assessment shall be of 10 Marks. The syllabus to be covered is mentioned in Appendix "B". There will be 09 short essay questions from this subject and there will be no choice. Each short essay question will carry 05 marks. There will be 45 MCQs and each question will carry 01 mark.

Oral & Practical **Marks:** 100

This exam shall consist of two parts: Part one OSPE shall be set by RMU, Key shall be provided. Part Two Viva which shall be equally divided in to internal and external. Marks distribution: 20 Marks for OPSE, 30 Marks internal examiner Viva, 30 external examiner Viva and 10 marks of log book. Internal Assessment shall be of 10 Marks.

Paper III Magnetic Resonance Imaging

Theory **Marks: 100**

The intention of this Examination in the subject of Magnetic Resonance Imaging is to assess the knowledge and cognitive skills underlying the intelligent performance of the tasks typically required of technologist at entry level into the profession. The examination in this subject shall consist of one Theory Paper of three hours duration and of maximum 90 marks. Internal assessment shall be of 10 Marks. The syllabus to be covered is mentioned in Appendix "B". There will be 09 short essay questions from this subject and there will be no choice. Each short essay question will carry 05 marks.
There will be 45 MCQs and each question will carry 01 mark.

Oral & Practical **Marks: 100**

This exam shall consist of two parts: Part one OSPE shall be set by RMU, Key shall be provided. Part Two Viva which shall be equally divided in to internal and external. Marks distribution: 20 Marks for OPSE, 30 Marks internal examiner Viva, 30 external examiner Viva and 10 marks of log book. Internal Assessment shall be of 10 Marks.

Paper-IV: Biostatistics & Research Methods

Theory **Marks: 50**

The examination in this subject shall consist of one Theory Paper of two hours duration and of maximum 45 marks. Internal assessment shall be of 05 Marks. The syllabus to be covered is mentioned in Appendix "B". There will be 04 short essay questions from this subject and there will be no choice. Each short essay question will carry 05 marks. There will be 25 MCQs and each question will carry 01 mark.

Oral Examination: Project & Viva **Marks: 50**

Viva on Research Project will be conducted by both internal and external examiners. Marks distribution: Viva will be of 45 Marks. Internal Assessment shall be of 5 Marks.

Annex: B

First Professional B.Sc. Hons. Medical Imaging Technology
Paper-I REGIONAL& IMAGING ANATOMY I

Theory Hours: 140
Practical Hours: 160

Description

Content begins with a review of gross anatomy of the entire body. Detailed study of gross anatomical structures will be conducted systematically for location, relationship to other structures and function. Gross anatomical structures are located and identified in axial (transverse), sagittal, coronal and orthogonal (oblique) planes. Illustrations and anatomy images will be compared with MR and CT images in the same imaging planes and at the same level when applicable. The characteristic appearance of each anatomical structure as it appears on a CT, MR and ultrasound image, when applicable, will be stressed. Students shall describe the structures of organs & their anatomical positions/relations of the following Contents in theory paper/ Exam. Students shall be able to Recognize and state anatomy from images i.e. X-ray, CT, MRI T1, images during Practical/ Viva

Objectives

◆ Name and describe the function of each anatomical structure located in the upper and lower extremities.

◆ Locate each anatomical structure in the upper and lower extremities on CT and MR images in the transverse axial, coronal, sagittal and oblique planes.

◆ Locate each anatomical structure on CT, MR and ultrasound images in the transverse axial, coronal, sagittal and orthogonal (oblique) cross-sectional imaging planes.

◆ Name the anatomical structures located within the thorax.

◆ Describe the relationship of each thoracic structure to surrounding structures.

◆ Describe the function of each anatomical structure located within the thorax.

◆ Locate each anatomical structure of the thorax on CT, MR and ultrasound images in the transverse axial, coronal, sagittal and oblique imaging planes.

◆ Understand the stages of embryonic development.

◆ Describe the procedures for the assessment of fetus.

Contents:

Section I: Upper extremities

1. Shoulder

a. Bony anatomy

1)Clavicle

2) Scapula

3) Humerus

4) Acromioclavicular joint b.

Muscles and tendons

1) Deltoid

2) Supraspinatus

3) Infraspinatus

4) Teres minor

5) Subscapularis

6) Supraspinatus tendon

7) Biceps tendon

c. Labrum and ligaments

1) Glenoid labrum

2) Glenohumeral ligaments

3) Coracoacromial ligament

4) Coracoclavicular ligaments

5) Bursa (sub acromial and subdeltoid)

d. Vascularity

2. Elbow

a. Bony anatomy

1) Humerus

2) Radius

3) Ulnar

b. Muscles and tendons

1) Anterior group

2) Posterior group

3) Lateral group

4) Medial group

c. Ligaments

1) Ulnar collateral

2) Radial collateral

3) Annular

d. Neurovasculature

1) Brachial artery

2) Radial artery

3) Ulnar artery

4) Basilic vein

5) Cephalic vein

6) Median cubital vein

7) Ulnar nerve

3. Hand and wrist

a. Bony anatomy

b. Phalanges
c. Metacarpals
1) Carpal bones
2) Radius
3) Ulnar
d. Tendons
1) Palmar tendon group
2) Dorsal tendon group
3) Triangular fibrocartilage complex
e. Neurovascular
1) Ulnar artery
2) Ulnar nerve
3) Radial artery
4) Median nerve

Section 2: Lower Extremities

1. Hip

a. Bony anatomy
b. Labrum and ligaments
c. Muscle groups
d. Neurovasculature

2. Knee

a. Bony anatomy
b. Menisci and ligaments
c. Muscles
d. Vasculature

3. Foot and Ankle

a. Bony anatomy
b. Ligaments
c. Tendons d. Muscles

Section III. Chest and Mediastinum

A. Bony thorax

1. Thoracic vertebrae
2. Sternum
3. Ribs
4. Costal cartilages
5. Scapulae
6. Clavicles

B. Pulmonary

1. Apices (lung)
2. Diaphragm
3. Angles
4. Hilum
5. Lobes (lungs)
6. Trachea
7. Carina

8. Primary (main stem) bronchi
9. Secondary bronchi

C. Mediastinum

1. Thymus gland
2. Heart
a. Arteries
b. Veins
c. Chamber
d. Valves
3. Pulmonary vessels
4. Coronary vessels
5. Ascending aorta
6. Aortic arch
7. Branches of the aortic arch
8. Descending (thoracic) aorta
9. Inferior vena cava
10. Esophagus
11. Trachea
12. Thoracic duct
13. Lymph nodes
14. Azygous vein
15. Hemiazygous vein

Breasts

Section IV: Clinically Oriented General Embryology:

1. **Introduction to human development:**
    a. Stages of embryonic development
    b. Genetics & human development
    c. Molecular biology of human development
    d. Gametogenesis, oogenesis, spermatogenesis
2. **First week of development:**
    a. Fertilization
    b. Cleavage
    c. Blastocyte formation
    d. Implantation of the embryo
3. **Second & Third week of development:**
    a. Completion of Implantation of Blastocyst
    b. Formation of Amniotic Cavity, Embryonic Disc, and Umbilical Vesicle
    c. Development of Chorionic Sac
    d. Implantation Sites of Blastocysts
    e. Gastrulation: Formation of Germ Layers Primitive Streak
    f. Notochordal Process and Notochord
    g. Allantois
    h. Neurulation: Formation of Neural Tube

4. **Third to Eight week of development:**
    a. Derivatives of the Ectodermal Germ Layer
    b. Derivatives of the Mesodermal Germ Layer
    c. Derivatives of the Endodermal Germ Layer
    d. Patterning of the Anteroposterior Axis: Regulation by Homeobox Genes
    e. External Appearance During the Second Month
5. **9th week to Birth:**
    a. Development of the Fetus
    b. Estimation of fetal age
    c. Fetal Membranes and Placenta
    d. Chorion Frondosum and Decidua Basalis
    e. Structure of the Placenta
    f. Amnion and Umbilical Cord
    g. Placental Changes at the End of Pregnancy
    h. Amniotic Fluid
    i. Fetal Membranes in Twins
    j. Parturition (Birth)
6. **Development of musculoskeletal sytem**
    a. Development of axial skeleton
    b. Striated Skeletal Musculature
    c. Innervation of Axial Skeletal Muscles
    d. Skeletal Muscle and Tendons
    e. Molecular Regulation of Muscle Development
    f. Patterning of Muscles
    g. Head Musculature
    h. Limb Musculature
    i. Cardiac Muscle
    j. Smooth Muscle
    k. Limb Growth And Development
    l. Limb Musculature
7. **Integumentry System:**
    a. Skin
    b. Hair
    c. Sweat Glands
    d. Mammary Glands
8. **Birth Defects & Prenatal diagnosis**
    a. Classification of Birth Defects
    b. Teratology: Study of Abnormal Development
    c. Birth Defects Caused by Genetic Factors
    d. Birth Defects Caused by Environmental Factors
    e. Procedures for assessing fetal status
    f. Prenatal diagnosis of birth defects

Recommended Readings:

1:- Clinical Anatomy by Richard Snell
2:- Clinically oriented Anatomy by Keith L. Moore
3:- Lasts Anatomy by R.M.H McMinn
4:-Atlas of human anatomy by Frank H Natter.
5:- Imaging atlas by Mosby.
6:-Anatomy for diagnostic Imaging by Stephanie Ryan.
7:- Clinically Oriented Embryology by Keith L. Moore.
8:- Langman's Medical Embryology by T.W. Sadler.

Paper-II BASIC PHYSIOLOGY

Total study hours: 200

BASIC PHYSIOLOGY

OBJECTIVES:

At the end student should be able to

- Describe the functional organization of human body
- Describe integumentary system (skin, hairs , nails) body temperature & its regulation
- Explain musculoskeletal system & the general characteristics & functions of skeletal muscle tissue
- Explain muscle hypertrophy & atrophy
- Describe the generalized function of nervous system
- Discuss cranial nerves
- Describe mechanism of transmission of nerve impulse and function of synapse and reflex arc
- Explain the physiology of eye, taste, hearing and balance and their function
- Compare the effects of nervous system and the endocrine system in controlling the body
- Identify the glands and the hormones produced by each endocrine gland ad describe the effect of each on the body
- Describe primary function of blood and composition of blood and plasma
- Describe electrical activity of heart origin and propagation of cardiac impulse
- Explain function of lymphatic system, tonsils, lymph nodes, spleen and thymus and can explain how blood pressure is commonly measured
- Describe the purpose of respiratory system and how respiration is regulated
- Describe the organs of digestive tract and accessory organ of digestion and biliary apparatus and can describe the physiology of absorption and transport
- Explain urine and urination and the role of lymphocyte in immunity regulation
- Discuss male and female reproductive system and the function of sex cells

COURSE CONTENTS:

(1) Introduction to the Human Physiology

- Functional organization---relationship between structure and function of the human body
- Homeostasis – its importance-- negative and positive feedback Mechanism

(2) Integumentary System

- Functions of the skin, hair, glands and nails
- Body temperature and its regulation

(3) The Musculoskeletal System:

- Functions of the bones and muscles
- Functional characteristics of Skeletal Muscle, Smooth Muscle and Cardiac Muscle
- The events of muscle contraction and relaxation in response to an action potential in a motor neuron.
- Distinguish between aerobic and anaerobic muscle contraction.
- Muscle hypertrophy and atrophy

(4) The Nervous System

Functions of the central nervous system**,**

- The functional areas of the cerebral cortex and their interactions.
- Functions of the parts of the brainstem diencephalons, basal nuclei. Limbic system. And cerebellum.
- Functions of various cranial nerves.

Functions of the somatic motor nervous system and Functions of the autonomic nervous system

- The function of neurons, neurological cells and their components.
- Resting membrane potential and an action potential.
- The function of a synapse and reflex arc

(5)The functions of the specialized sense organs

- Eye---- physiology of site, accommodation, optic nerve and optic chiasms
- Ear---- functions of the internal, middle and external ear
- Physiology of the hearing and balance
- Smell---------- physiology of olfactory nerve
- Taste ---------physiology of taste
- Location of the taste buds
- Physiology of speech

(6) The Endocrine System

- Functions of the Endocrine System
- Chemical Signals, receptors and hormones
- The Endocrine Glands and their Hormones

(7) Blood

- Composition of Blood and Plasma
- Functions of Blood
- Formed Elements
- Stages of cell development
- Blood grouping
- Coagulation mechanism and factors

(8) The Cardiovascular system

- Functions of the Heart
- Electrical Activity of the Heart origin and propagation of cardiac impulse
- Phases of the Cardiac Cycle
- Heart Sounds
- Regulation of Heart Functions--- intrinsic and extrinsic
- Functions of the Peripheral Circulation
- The Physiology of Circulation
- Pulmonary Circulation
- Systemic Circulation: Arteries
- Veins
- Local Control of Blood Vessels
- Nervous Control of Blood Vessels
- Regulation of Arterial Pressure
- The function of Lymphatic System, tonsils, lymph nodes, the spleen and the thymus.

(9) Respiratory System

- Functions of the Respiratory System beginning at the nose and ending with the alveoli.
- Ventilation and Lung Volumes
- Gas Exchange and gas transport in the blood
- Rhythmic Ventilation

(10)The Digestive System

- Functions of each organ of the Digestive System including major salivary glands
- Movements and Secretions in each organ of the Digestive System and their regulation
- Physiology of Digestion, Absorption, and Transport

(11) Genito-Urinary System

- Urine Production, Urine Movement

- Regulation of Urine Concentration and Volume
- Body Fluid Compartments
- Regulation of Extra-cellular Fluid Composition
- Regulation of Acid-Base Balance
- Physiology of Male Reproductive system—spermatogenesis and reproductive glands, hormones and their regulations
- Physiology of Female Reproductive system--- ovulation, hormones and their regulations
- Physiology of ovulation and menstrual cycle

(12) Immunity

- Define immunity, Innate Immunity, Adaptive Immunity
- Antigens and Antibodies
- Primary and secondary response to an antigen
- Antibody-mediated immunity and cell mediated immunity
- Role of lymphocyte in immunity regulation

Recommended Books:

- Text Book of Medical Physiology Guyton
- Essentials of Anatomy and Physiology by See lay, Stephens and Tate. 4thedition
- Ross & Wilson Anatomy and Physiology.
- Human Physiology. Stuart Ira Fox. 7th edition
- Essential of Medical Physiology Vol.I & II by Mehta Ahmad.
- Lecture notes on human physiology by Bray JJ, Crags, PA McKnight

PAPERIII: BASIC BIOCHEMISTRY & GENERAL PATHOLOGY

Total study hours: 200

Syllabi and Courses of Reading

Note: Syllabi and courses of reading are divided into two parts. 100 hours will be allocated for Section I and 100 hours will be allocated for the Section II.

Section -I: BASIC BIOCHEMISTRY

Objectives:

At the end the student should be able to

- Explain role of carbohydrates, fats & proteins their dietary sources & uses in body
- Describe the forms, digestion and metabolism of carbohydrates
- Describe differences and similarities among monosaccharide, disaccharides, and polysaccharide and food sources of each
- Explain the regulation of blood glucose
- Describe how fats & amino acids are metabolized
- Describe generalized enzyme-substrate reaction and describe how enzyme is able to speed up chemical reaction
- Describe about proteins, their structure, bond and classification
- Explain the properties of proteins and their functions in human body
- Describe how enzyme work and know how to determine basic enzyme kinetics
- Explain the specificity of enzymes (biochemical catalyst) & the chemistry involved in enzyme action
- Describe about vitamins and their classifications
- Identify the vitamin deficiency effects
- Describe the classes of lipids

CONTENTS:

(1) Physiochemical Principles

- Hydrogen ion conc. and pH notation
- Acidity & Alkalinity
- Indicators & Buffer solutions
- PH and its determination
- The colloidal state
- Absorption
- Structure and function of cell membrane and movement of materials across cell membrane
- Osmosis & Osmotic pressure
- Surface tension
- Viscosity

(2) Carbohydrates

- Introduction and classification of carbohydrates
- Some important monosaccharide's, disaccharides and polysaccharides
- Regulation of blood glucose level and glucose tolerance test
- Definition and end products of
- Glycol sis
- Citric acid cycle
- Glycogenolysis
- Glycogenoses
- Gluconeogenesis

(3) Proteins and Amino Acids

- Introduction, importance, classification and properties of proteins
- Entry of amino acids into cells and peptide linkage, essential amino acids, Special sources of proteins

(4) Lipids

- Introduction, Classification and Function of lipids
- Biosynthesis of fatty acids, natural fats or triglycerides
- Fatty acid oxidation, saturated and un-saturated fats

(5) Vitamins and Minerals

- Classification of vitamins
- Fat soluble vitamins and Water soluble vitamins
- Deficiency effects

(6) Enzymes

- Introduction, Classification Chemical nature and properties of enzymes
- The mechanism of enzyme reactions
- Factors affecting the enzyme activity
- Important coenzymes and their actions
- Regulatory enzymes

(7) Nutrition and Dietetics

- Balanced diet
- Role of carbohydrates, fats and proteins, their dietary sources and uses in the body
- Quantitative and qualitative daily requirements of carbohydrates, fats, proteins, vitamins and minerals

Recommended Books

- Review of Biochemistry by Lippincott
- Harper's illustrated Biochemistry by Robert K. Murray
- Essential of Medical Biochemistry Vol.I & II by Mushtaq Ahmad.
- Fundamentals of Biochemistry by D. Voet, J.G.Voet (1999)
- Text Book of Biochemistry with Clinical Correlations by T.M.Devlin.
- Modern Experimental Biochemistry by R.F.Boyer.

Section -II: GENERAL PATHOLOGY

OBJECTIVES:

At the end student should be able to

- Define hyperplasia, hypertrophy, atrophy, and metaplasia and their causes
- Describe mechanism of necrosis and gangrene
- Describe fatty change, pigmentation and pathologic calcification
- Describe the causes and process of inflammation
- Contrast the difference between acute and chronic inflammation
- Explain how fluid balance is maintained across the arteriolar and venular end of the vasculature and difference between arterial and venous emboli
- Understand and explain the cause and pathogenesis of myocardial infarction, deep venous thrombosis, pulmonary thromboembolism
- Explain various types of shock, their pathogenesis, manifestations, and complications
- Describe the consequences of thrombosis
- Differentiate neoplastic lesions from non-neoplastic ones
- Contrast benign from malignant tumors
- Describe etiologic factors in carcinogenesis and clinical effects of neoplasm

CONTENTS:

(1) Cell Injury and adaptation

Cell Injury

- Reversible and Irreversible Injury
- Fatty change, Pigmentation, calcification (Metastatic / Dystrophic)
- Necrosis and Gangrene

Cellular adaptation

- Atrophy, Hypertrophy,
- Hyperplasia, Metaplasia, Aplasia

(2) Inflammation

- **Acute inflammation** --- vascular changes, Chemotaxis, Opsonization and Phagocytosis

- Enlist the cellular components and chemical mediators of acute inflammation
- Differentiate between exudates and transudate
- **Chronic inflammation**
- Etiological factors, Granuloma

(3) Cell repair and wound healing

- Regeneration and Repair
- Healing--- steps of wound healing by first and second intention
- Factors affecting healing
- Enlist the complications of wound healing

(4) Hemodynamic disorders

- Define and classify the terms Edema, Hemorrhage, Thrombosis, Embolism, Infarction & Hyperemia with at least two examples of each.
- Define and classify Shock with causes of each.
- Describe the compensatory mechanisms involved in shock
- Describe the possible consequences of thrombosis
- Describe the difference between arterial and venous emboli

(5) Neoplasia

- Define the terms Dysplasia, Metaplasia and Neoplasia with examples of each
- Enlist the differences between benign and malignant neoplasms
- Enlist the common etiological factors for neoplasia
- Define and discuss the different modes of metastasis

(6) Diseases of Immune system:

- Innate & Adaptive immunity
- Cells & tissues of immune system
- Hyper sensitivity diseases: Mechanism of immune mediated injury.
- Rejection of transplants
- Auto immune diseases
- Immune deficiency diseases

Recommended Books

Medium Robbins Basic Pathology by Kumar, Abbas, Fausto, Mitchel

PAPER-IV: ISLAMIC STUDIES/ETHICS & PAKISTAN STUDIES

Study Hours:100

Syllabi and Courses of Reading

Note: Syllabi and courses of reading are divided into two parts, 50 hours will be allocated for Section I and 50 hours will be allocated for the Section II. Question paper will carry 60 marks for Islamic Studies/Ethics and 40 marks for Pakistan studies. Non-Muslims can appear in the subject of Ethics instead of Islamic Studies. Candidates can attempt paper in Urdu or English.

ETHICS:

1. Ethical Teachings of world religious with special reference to Buddhism, Judaism Christianity and Islam.
2. 100 ethical precepts from Quran and Sayings of the Prophet.

The Arabic text of Holy Quran and A hadith would not be advisable for inclusion in the syllabus for the Non-Muslims. Instead the teachings of Holy Quran and Sunna relating to the following topic should be explained in English or Urdu, hence, questions about this portion of the syllabus should be based on the subject-matter, and not on the texts.

Virtues

Duty towards parents: respect for human life, unity of mankind, peace, justice, tolerance, beneficence, pity, contentment, chastity, meekness, repentance, social solidarity, individual accountability, moral excellence, patience and perseverance, forgiveness,

Vices

Arrogance, ostentation, extravagance, misery, greed, jealousy, suspicion, backbiting, coercion, hypocrisy, bribery, obscenity and immodesty.

1. Promotion of moral values in society.
2. Attitude of Islam Towards Minorities

Section -I: ISLAMIC STUDIES

Theory Marks: 60
Study Hours: 50

مقاصد: اس نصاب کی تدریس کا مقصد طلباء کو اس قابل بنانا ہے کہ وہ :-

۱۔ اسلام کے معنی و مفہوم کو سمجھ سکیں۔

۲۔ اسلام کی بنیادی تعلیمات کو اچھی طرح سمجھ کر ان پر عمل کر سکیں۔

۳۔ یہ حقیقت ذہن نشین کر سکیں کہ اسلام ہی آج کی انسانی زندگی کے تمام مسائل کو بطریق احسن حل کرنے کی صلا

نصاب:

کتاب و سنت

(ا) قرآن مجید

۱۔ فضائل قرآن ۲۔ سورہ الحجرات، متن اور ترجمہ مکمل ۳۔ سورہ الفرقان، عباد الرحمن۔ الی آخر السعدہ، آیت ۷۷ تا ۳۲۳۔

(ب) سنت

سنت کی اہمیت۔

بیس منتخب احادیث، متن و ترجمہ کے ساتھ۔

۱. وَعَنْ عَبْدِاللّٰهِ ابْنِ عَمْرٍو قَالَ قَالَ رَسُوْلُ اللّٰهِ صَلَّى اللّٰهُ عَلَيْهِ وَسَلَّمَ لَا يُؤْمِنُ اَحَدُكُمْ حَتّٰى يَكُوْنَ هَوَاهُ تَبَعًا لِّمَا جِئْتُ بِهٖ۔

۲. عَنْ عُثْمَانَ بْنِ عَفَّانَ رَضِيَ اللّٰهُ عَنْهُ عَنِ النَّبِيِّ صَلَّى اللّٰهُ عَلَيْهِ وَ سَلَّمَ اِنَّ اَفْضَلَكُمْ مَنْ تَعَلَّمَ الْقُرْاٰنَ وَعَلَّمَهٗ۔

۳. يَنْبَغِيْ لِلْمُؤْمِنِ اَنْ لَا يَمُوْتَ حَتّٰى يَتَعَلَّمَ الْقُرْاٰنَ اَوْ يَكُوْنَ فِيْ تَعْلِيْمِهٖ۔

٤. عَنْ عُمَرَ بْنِ الْخَطَّابِ رَضِيَ اللّٰهُ عَنْهُ قَالَ قَالَ رَسُوْلُ اللّٰهِ صَلَّى اللّٰهُ عَلَيْهِ وَ سَلَّمَ اِنَّ اللّٰهَ يَرْفَعُ بِهٰذَا الْكِتٰبِ اَقْوَامًا وَّ يَضَعُ بِهٖ اٰخَرِيْنَ۔

٥. عَنْ مُسْلِمَةَ بْنِ قَيْسٍ رَضِيَ اللّٰهُ عَنْهُ قَالَ قَالَ رَسُوْلُ اللّٰهِ صَلَّى اللّٰهُ عَلَيْهِ وَ سَلَّمَ اِسْتَشْفِ بِالْقُرْاٰنِ فَاِنَّ اللّٰهَ يَقُوْلُ وَشِفَآءٌ لِّمَا فِي الصُّدُوْرِ وَفِيْ رِوَايَةٍ عَنْهُ مَنْ لَّمْ يَسْتَشْفِ الْقُرْاٰنَ فَلَا شَفَاهُ اللّٰهُ۔

٦. عَنْ مُعَاذِ بْنِ جَبَلٍ رَضِيَ اللّٰهُ عَنْهُ عَنِ النَّبِيِّ صَلَّى اللّٰهُ عَلَيْهِ وَ سَلَّمَ قَالَ ثَلَاثٌ مَّنْ كُنَّ فِيْهِ فَهُوَ مُنَافِقٌ وَاِنْ صَلّٰى وَصَامَ وَزَعَمَ اَنَّهٗ مُؤْمِنٌ اِذَا حَدَّثَ كَذَبَ وَاِذَا وَعَدَ اَخْلَفَ وَ اِذَا اؤْتُمِنَ خَانَ۔

۷. عَنِ بْنِ رَضِيَ اللّٰهُ عَنْهُ عَنِ النَّبِيِّ صَلَّى اللّٰهُ عَلَيْهِ وَ سَلَّمَ قَالَ لَا يُؤْمِنُ اَحَدُكُمْ حَتّٰى يُحِبَّ لِاَخِيْهِ مَا يُحِبُّ لِنَفْسِهٖ۔

۸. عَنْ عَائِشَةَ رَضِيَ اللّٰهُ عَنْهَا عَنِ النَّبِيِّ صَلَّى اللّٰهُ عَلَيْهِ وَ سَلَّمَ قَالَ خَيْرُ النَّاسِ اَنْفَعُهُمْ لِلنَّاسِ وَ فِيْ رِوَايَةٍ خَيْرُ النَّاسِ مَنْ يَّنْفَعُ بِهِ النَّاسَ۔

۹. عَنْ اَنَسِ بْنِ مَالِكٍ رَضِيَ اللّٰهُ عَنْهُ قَالَ قَلَّمَا خَطَبَنَا رَسُوْلُ اللّٰهِ صَلَّى اللّٰهُ عَلَيْهِ وَ سَلَّمَ اِلَّا قَالَ لَا اِيْمَانَ لِمَنْ لَّا اَمَانَةَ لَهٗ وَلَا دِيْنَ لِمَنْ لَّا عَهْدَ لَهٗ۔

۱۰. عَنْ الْحَسَنِ رَضِيَ اللّٰهُ عَنْهُ مُرْسَلًا حُبُّ الدُّنْيَا رَاْسُ كُلِّ خَطِيْئَةٍ۔

۱۱. عَنْ اَبِيْ سَعِيْدِ الْخُدْرِيِّ رَضِيَ اللّٰهُ عَنْهُ قَالَ سَمِعْتُ رَسُوْلَ اللّٰهِ صَلَّى اللّٰهُ عَلَيْهِ وَ سَلَّمَ يَقُوْلُ مَنْ رَاٰى مِنْكُمْ مُنْكَرًا فَلْيُغَيِّرْهُ بِيَدِهٖ فَاِنْ لَّمْ يَسْتَطِعْ فَبِلِسَانِهٖ وَ اِنْ لَّمْ يَسْتَطِعْ فَبِقَلْبِهٖ وَ ذٰلِكَ اَضْعَفُ الْاِيْمَانِ۔

۱۲۔ عَن عَائِشَةَ رَضِیَ اللّٰہُ عَنۡہَا عَنِ النَّبِیِّ صَلَّی اللّٰہُ عَلَیۡہِ وَ سَلَّمَ قَالَ اِذَا اَکَلَ اَحَدُکُمۡ فَلۡیَذۡکُرِ اسۡمَ اللّٰہِ وَ اِنۡ نَسِیَ اَنۡ یَذۡکُرَ اسۡمَ اللّٰہِ فِیۡ اَوَّلِہٖ فَلۡیَقُلۡ بِاسۡمِ اللّٰہِ اَوَّلَہٗ وَ اٰخِرَہٗ۔

۱۳۔ عَنۡ اِبۡنِ عَبَّاسٍ رَضِیَ اللّٰہُ عَنۡہُ قَالَ نَھٰی رَسُوۡلُ اللّٰہِ صَلَّی اللّٰہُ عَلَیۡہِ وَ سَلَّمَ اَنۡ یُّتَنَفَّسَ فِی الۡاِنَاءِ اَوۡ یُنۡفَخَ فِیۡہِ۔

۱۴۔ عَنۡ مِقۡدَامِ ابۡنِ مَعۡدِی کَرِبٍ رَضِیَ اللّٰہُ عَنۡہُ عَنِ النَّبِیِّ صَلَّی اللّٰہُ عَلَیۡہِ وَ سَلَّمَ قَالَ مَا مَلَاءَ اٰدَمِیٌّ وِعَاءً شَرًّا مِنۡ بَطۡنِہٖ بِحَسۡبِ ابۡنِ اٰدَمَ اُکُلَاتٌ یُقِمۡنَ صُلۡبَہٗ فَاِنۡ کَانَ لَا مَحَالَۃَ فَثُلُثٌ لِطَعَامِہٖ وَ ثُلُثٌ لِشَرَابِہٖ وَ ثُلُثٌ لِنَفَسِہٖ۔

۱۵۔ عَن عَائِشَةَ رَضِیَ اللّٰہُ عَنۡہَا قَالَتۡ مَا شَبِعَ اٰلُ مُحَمَّدٍ صَلَّی اللّٰہُ عَلَیۡہِ وَ سَلَّمَ مُنۡذُ قَدِمَ الۡمَدِیۡنَۃَ مِنۡ طَعَامِ بُرٍّ ثَلَاثَ لَیَالٍ تِبَاعًا حَتّٰی قُبِضَ۔

۱۶۔ عَنۡ عُبَیۡدِ اللّٰہِ ابۡنِ مُحۡصِنٍ عَنۡ اَبِیۡہِ اَنَّ النَّبِیَّ صَلَّی اللّٰہُ عَلَیۡہِ وَسَلَّمَ قَالَ مَنۡ اَصۡبَحَ مِنۡکُمۡ اٰمِنًا فِی سِرۡبِہٖ مُعَافًی فِیۡ جَسَدِہٖ عِنۡدَہٗ قُوۡتُ یَوۡمِہٖ فَکَاَنَّمَا حِیۡزَتۡ لَہُ الدُّنۡیَا۔

۱۷۔ عَنِ الۡحَارِثِ ابۡنِ عَاصِمِ الۡاَشۡعَرِی رَضِیَ اللّٰہُ عَنۡہُ قَالَ ، قَالَ رَسُوۡلُ اللّٰہِ صَلَّی اللّٰہُ عَلَیۡہِ وَسَلَّمَ الطُّھُوۡرُ شَطۡرُ الۡاِیۡمَانِ وَ فِیۡ رِوَایَۃٍ لِلتِّرۡمَذِیِّ اِنَّ اللّٰہَ طَیِّبٌ یُحِبُّ الطَّیِّبَ نَظِیۡفٌ یُحِبُّ النَّظَافَۃَ۔

۱۸۔ عَنۡ اَبِیۡ ھُرَیۡرَۃَ رَضِیَ اللّٰہُ عَنۡہُ عَنِ النَّبِیِّ صَلَّی اللّٰہُ عَلَیۡہِ وَ سَلَّمَ قَالَ لَوۡ لَا اَنۡ اَشُقَّ عَلٰی اُمَّتِیۡ لَاَمَرۡتُھُمۡ بِالسِّوَاکِ عِنۡدَ کُلِّ صَلٰوۃٍ۔

۱۹۔ عَنۡ اَبِی الدَّرۡدَاءِ رَضِیَ اللّٰہُ عَنۡہُ عَنِ النَّبِیِّ صَلَّی اللّٰہُ عَلَیۡہِ وَ سَلَّمَ اِنَّ اللّٰہَ اَنۡزَلَ الدَّوَاءَ وَالدَّوَاءَ وَ جَعَلَ لِکُلِّ دَاءٍ دَوَاءً فَتَدَاوَوۡا وَلَا تَتَدَاوَوۡا بِحَرَامٍ۔

۲۰۔ عَنۡ اَبِیۡ ھُرَیۡرَۃَ رَضِیَ اللّٰہُ عَنۡہُ عَنِ النَّبِیِّ صَلَّی اللّٰہُ عَلَیۡہِ وَ سَلَّمَ (فِیۡ حَدِیۡثٍ طَوِیۡلٍ) قَالَ اِنَّ اللّٰہَ عَزَّوَجَلَّ یَقُوۡلُ یَوۡمَ الۡقِیَامَۃِ یَا ابۡنَ اٰدَمَ مَرِضۡتُ فَلَمۡ تَعُدۡنِیۡ قَالَ یَارَبِّ کَیۡفَ اَعُوۡدُکَ وَاَنۡتَ رَبُّ الۡعَالَمِیۡنَ؟ قَالَ اَمَا عَلِمۡتَ اَنَّ عَبۡدِیۡ فُلَانًا مَرِضَ فَلَمۡ تَعُدۡہُ اَمَا عَلِمۡتَ لَوۡ عُدۡتَہٗ لَوَجَدۡتَنِیۡ عِنۡدَہٗ۔

۳۔ دین اسلام۔ آیات قرآنی اور احادیث کی روشنی میں:

۱۔ توحید ۲۔ رسالت ۳۔ آخرت ۴۔ نماز ۵۔ روزہ ۶۔ زکوٰۃ ۷۔ حج ۸۔ جہاد

۴۔ اسوہ حسنہ، حضور صلی اللہ علیہ وسلم کی سیرت کا مطالعہ

۱۔ رہبر مدنیت ۲۔ معلم و محرک ۳۔ مبلغ و داعی ۴۔ سپہ سالار ۵۔ مدبر شام ۶۔ سربراہ خاندان ۷۔ تاجر ۸۔ عابد و

تعمیر کردار و تمہید (اسلام میں تعمیر کردار کی اہمیت)

(الف) اخلاق حسنہ

تقوی اور اخلاص، صدیق، سخاوت، عفت، دیانتداری، رحم، عدل (سماجی، معاشی انصاف) احسان ایفائے عہد، ایثار، سادگی، روا آدمیت، اخوت، والدین اور بزرگوں کا احترام، کسب حلال۔

(ب) رذائل اخلاق، تعارف تمہید

تکبر، بہتان طرازی، غیبت، منافقت، خوشامد، حرص، ناپ تول میں کمی بیشی، رشوت اسراف، سود، حسد، نمائش پسندی، ذخ تہذیب انسانی کی تعمیر میں (Role of Ethics)۔

امت مسلمہ، احیائے اسلام کی تحریکیں اور ہمارا مستقبل۔

Section -II: PAKISTAN STUDIES

Total Marks: 40

Study Hours: 50

مقاصد: پاکستان کا ایسا مطالعہ جس سے طلبہ میں ماضی پر فخر، حال کے لئے جوش وخروش اور مستقبل پر مستحکم اعتماد ہو ان کا یہ پختہ عقیدہ ہو کہ قومی استحکام اور ملکی ترقی کے لئے وہ سب کچھ کرنا ہے جس کے وہ اہل ہیں۔ تعمیر وطن کے لئے یہ ایک جذباتی احساس ہی نہ ہو بلکہ نظریہ پاکستان کی علمی تعبیر اور تحریک پاکستان کو صحیح معنوں میں سمجھنا نتیجہ ہو۔

یہ کورس افراد پاکستان کی ذہنی تربیت کا ایسا درسی مواد ہو کہ جو کہ پاکستانی تشخیص، اپنی روایات پر یقین کو مستحکم بنائے اور علمی زندگی میں ایسے تعمیری رویہ کی جانب رہنمائی کرے جو کہ قوم کو اسلامی اقدار سے قریب تر کرنے میں معاون ہو۔ مختصراً یہ قومی پالیسی کے نصب العین، پاکستان کے اسلامی نظریہ کو قائم رکھنا۔ تقویت دینا اور مستحکم کرنا اور عملی تربیت کے ذریعہ اس کو انفرادی اور قومی زندگی کا شعار بنانا کی تفسیر ہو۔

یونٹ نمبر (۱) نظریہ پاکستان

۱۔ قیام پاکستان کے اغراض ومقاصد

۲۔ نظریہ پاکستان

☆ تعریف وتوضیع۔ ☆ نظریہ پاکستان اقبال اور قائداعظم کے ارشادات کی روشنی میں۔

یونٹ نمبر (۲) برصغیر میں مسلم معاشرہ کی تشکیل وارتقاء۔

یونٹ نمبر (۳) نظریہ پاکستان کا تاریخی پہلو۔

۱۔ برصغیر میں مسلم دور حکومت۔

۲۔ مسلم اقتدار کا زوال ارنشاہ کی کوشش۔

۳۔ ملی اصلاحی تحریکیں (شیخ احمد میر ہندی)۔ (شاہ ولی اللہ اور مابعد)۔

۴۔ تعلیمی کوششیں (علی گڑھ، دیوبند، انجمن حمایت اسلام اور دیگر مقامی تعلیمی ادارے سندھ مدرسہ، اسلامیہ کالج، پشاور)

۵۔ سیاسی جدوجہد۔

☆ آئینی اصلاحات ارمسلمان۔ جداگانہ انتخاب، ☆ تحریک خلافت

یونٹ نمبر (۴): تحریک پاکستان

۱۔ مسلم قومیت اور دو قومی نظریہ کا ارتقاء
۲۔ ہندوستان کی آزادی کا مسئلہ اور مسلمان۔
۳۔ علامہ اقبال کا خطبہ الہ آباد۔
۴۔ انتخاب ۱۹۳۷ء اور کانگریس حکومتوں کا رویہ۔
۵۔ قرارداد پاکستان
۶۔ ہندو انگریز کا ردعمل۔
۷۔ ۱۹۴۶ کے انتخابات اور انتقال اقتدار

یونٹ نمبر (۵): پاکستان کے حصول کے لئے جدوجہد

پاکستان کے لئے مسلم عوام کی جدوجہد

۱۔ اقلیتی صوبوں کے مسلمانوں کا کردار اور ایثار۔
۲۔ سرحد، بلوچستان، سندھ، کشمیر اور پنجاب کے مسلمانوں کا حصہ۔

یونٹ نمبر (۶): تحریک پاکستان میں:

۱۔ علماء اور مشائخ۔
۲۔ ادیب اور صحافی۔
۳۔ طلباء اور خواتین کا حصہ۔

یونٹ نمبر (۷) قیام پاکستان کے اہم واقعات

۱۔ ہندوستان میں مسلم کش فسادات، مشرقی پنجاب میں قتل۔
۲۔ نہری پانی اور اثاثوں کی تقسیم
۳۔ ریاستوں کے الحاق کا مسئلہ۔ حیدر آباد۔ جونا گڑھ اور کشمیر۔

یونٹ نمبر(۸): پاکستان میں نظام اسلام کے نفاذ کی کوشش

۱۔ قرارداد مقاصد۔

۲۔ ۱۹۵۶، ۱۹۶۲اور ۱۹۷۳ کے آئین کی اسلامی دفعات

۳۔ نماز شریعت، ابتدائی اقدامات۔

۴۔ ہماری منزل۔مکمل اسلامی معاشرہ کا قیام

یونٹ نمبر(۹): ارض پاکستان

(الف) جغرافیائی وحدت

محل وقوع، جغرافیائی اہمیت، دیہی وشہری علاقے۔

(ب) قدرتی وسائل

(ج) زراعت

(د) صنعت

(ر) درآمد و برآمد

(ہ) افرادی قوت

یونٹ نمبر(۱۰): پاکستان اور عالم اسلام

Paper-V: BEHAVIOURAL SCIENCES & COMPUTER EDUCATION

Total study hours: 200

Syllabi and courses of reading

Note: Syllabi and courses of reading are divided into two parts. 100 hours will be allocated for Section I and 100 hours will be allocated for the Section II.

Section -I:
BEHAVIOURAL SCIENCES

Study hours: 100

1. Introduction to Behavioral Sciences and its importance in health.

Bio-Psycho-Social Model of Health Care and the Systems Approach
Normality vs Abnormality
Importance of Behavioural sciences in health
Desirable Attitudes in Health Professionals

2. Understanding Behaviour

Sensation and sense organs

Describe sensation, sense organs/special organs

Perception

Define perception, what factors affecting perception

Attention and concentration

Define attention and concentration. What factors affecting them

Memory

Define memory and describe its stages, types and methods to improving it

Thinking

Define thinking; describe its types and theories
what is cognition and levels of cognition?
Discuss problem solving and decision making strategies

Communication

Define communication. What are types, modes and factors affecting it? Describe ways to recognize non-verbal cues. Characteristics of a good communicator

3. Individual Differences

Personality

Define personality. What factors affect personality development? How personality can be assessed? Influence of personality in determining reactions during health, disease, hospitalization, stress

Intelligence.

Define intelligence and the various types of intelligence.
What factors affect it and how it can be assessed?

Emotions

Define emotions. What are the various types of emotions?
Emotional Quotient (EQ) - concept & utility

Motivation

Define motivation and what are the types of motivation?

4. Learning

Define learning, Principles of learning, modern methods and styles of learning, types of learners, Strategies to improve learning skills

5. Stress and Stressors

Define and classify stress and stressors
Relationship of stress and stressors with illness

6. Life Events

Concept of life events and their relationship with stress and illness

7. Stress Management

What is coping skills?
What is conflict and frustration?
What is concept of adjustment and maladjustment?

8. Interviewing / Psychosocial History Taking

Define, types of interview and listening
Skills of interviewing and listening

9. Allied Health Ethics-Hippocratic Oath

Do's and Don'ts
What is the concept of Allied Health ethics?

10. Culture and Allied Health practice

Concept of group, its dynamics
Attitude, value, belief, myths, social class, stigma, sick role and illness, health belief models

11. Psychological reactions

Grief and bereavement, Family and illness

Dealing with difficult patients

What are the psychosocial aspects of illness, hospitalization, rape, torture, terminal illness, death and dying?

Psychosocial issues in Emergency Departments, Intensive Care and Coronary

Care Units, Operating Theatres, Cancer wards, Transplant Units, Anesthesia

12. Breaking Bad News

Introduction, Models, Methods, Death of the patient, abnormal baby, intractable illness

13. Pain, Sleep, Consciousness

Concept of pain.

Physiology of pain,

Altered states of consciousness.

14. Communication SkillsCounseling,

Crisis Intervention

Conflict Resolution

Principles of effective communication, active listening, the art of questioning, the art of listening.

Good and bad listener.

Counseling: Scope, Indications and Contraindications,

Steps, Do's and Don'ts, How to deal with real life crisis and conflict situations in health settings

Section II:
COMPUTER EDUCATION

Study hours: 100 hours

1. Introduction to Computers

Definition

- Usage and functionality of computers
- Limitations of Computers
- Classification of Computers
- Basic Components of Computers

2. Hardware

3. Software

- System Software
- Application Software
- Equipment's/devices in Personal computer system
- Input devices
- Output devices
- Storage devices
- The processor

4. Microsoft Windows

- Introduction to MS-Windows
- Arranging, Moving and Resizing Windows.
- Identifying the components of desktop.
- Moving, Changing and Closing Windows.
- Crating, Opening and Deleting items and folders. Working with My Computer
- Deleting and Resume Print Jobs.
- Using Control Panel
- Working with Accessories.

5. Microsoft Office

- Microsoft Word
- Microsoft Excel
- Microsoft Power Point

6. Database Internet and Email

- Introduction To Outlook Express
- Using Internet Explorer

Recommended Readings:

Computer for beginners by IT series

Second Professional B.Sc. Hons. Medical Imaging Technology

Paper-I REGIONAL& IMAGING ANATOMY II

Theory Hours: 140
Practical Hours: 160

Description

Content begins with a review of gross anatomy of the entire body. Detailed study of gross anatomical structures will be conducted systematically for location, relationship to other structures and function. Gross anatomical structures are located and identified in axial (transverse), sagittal, coronal and orthogonal (oblique) planes. Illustrations and anatomy images will be compared with MR and CT images in the same imaging planes and at the same level when applicable. The characteristic appearance of each anatomical structure as it appears on a CT, MR and ultrasound image, when applicable, will be stressed. Students shall describe the structures of organs & their anatomical positions/relations of the following Contents in theory paper/ Exam. Students shall be able to Recognize and state anatomy from images i.e. X-ray, CT, MRI T1, images during Practical/ Viva

Objectives

◆ Name the anatomical structures located within the head and neck.

◆ Describe the relationship of each anatomical structure in the head and neck to surrounding structures.

◆ Describe the function of each anatomical structure in the head and neck.

◆ Locate each anatomical structure on CT, MR and ultrasound images in the transverse axial, coronal, sagittal and orthogonal (oblique) cross-sectional imaging planes.

◆ List and describe the function of each anatomical structure located within the abdomen and pelvis.

◆ Describe the relationship of each anatomical structure in the abdomen and pelvis to surrounding structures.

◆ Locate each anatomical structure of the abdomen and pelvis on CT, MR, PET and ultrasound images in the axial, coronal, sagittal and oblique planes.

◆ Locate each anatomical structure in the upper and lower extremities on CT and MR images in the transverse axial, coronal, sagittal and oblique planes.

◆ Understand the stages of embryonic development.

◆ Understand the congenital malformation of body systems.

Contents:

Section I. Head and Brain

A. Surface anatomy of the brain

1. Fissures (sulci)
a. Longitudinal cerebral
b. Lateral (Sylvian)
c. Central (of Rolando)
2. Convolutions (gyri)
a. Precentral
b. Post central

B. Sinuses

1. Frontal
2. Maxillary
3. Ethmoidal
4. Sphenoidal

C. Facial bones

1. Mandible
2. Maxillae
3. Zygomas
4. Nasal bones

D. **Facial muscles**

E. **Cranial bones**

1. Frontal
2. Ethmoid
a. Nasal conchae (turbinate's)
b. Nasal septum
3. Parietal
4. Sphenoid
a. Lesser wings
1) Tuberculum sellae
2) Sellaturcica
3) Dorsum sellae
4) Anterior and posterior clinoid process
5) Optic canals
b. Greater wings
1) Foramen rotundum
2) Foramen ovale
a) Foramen spinosum
5. Occipital
a. Foramen magnum
b. Internal and external occipital protuberance

c. Jugular foramen
6. Temporal
a. Zygomatic process
b. External auditory meatus (EAM)
c. Internal auditory canal
d. Mastoid process
e. Petrous portion or ridge

F. Lobes of the brain and midline cerebral hemisphere structures

1. Frontal
2. Parietal
3. Occipital
4. Temporal
5. Insula (Island of Reil)
6. Cerebellum
7. Corpus callosum (genu, rostrum, body and splenium)
8. Septum pellucidum
9. Sellaturcica
10. Pineal gland
11. Falxcerebri
12. Septum pellucidum

G. Cranial nerves

1. Olfactory
2. Optic
3. Oculomotor
4. Trochlear
5. Trigeminal
6. Abducens
7. Facial
8. Vestibulocochlear
9. Glossopharyngeal
10. Vagus
11. Accessory
12. Hypoglossal

H. Brainstem and adjoining structures

1. Diencephalon
a. Thalamus
b. Hypothalamus
c. Optic chiasm
d. Optic tracts
e. Infundibulum (pituitary stalk)
f. Pituitary gland
g. Mammillary bodies
h. Pineal gland
2. Midbrain
3. Pons

4. Medulla oblongata
a. Spinal cord
I. Arteries (Circle of Willis)
1. Vertebral
2. Basilar
3. Internal carotid
4. Anterior and posterior communicating
5. Anterior and posterior cerebral
6. Middle cerebral
J. Veins
1. Venous sinuses
a. Superior sagittal sinus
b. Vein of Galen
c. Straight sinus
d. Confluence of sinuses
e. Transverse sinus
f. Sigmoid sinus
2. Internal jugular

K. Ventricular system

1. Lateral ventricles (anterior, body, posterior, inferior or temporal and trigon or antrium)
2. Interventricular foramen (of Monro)
3. Third ventricle
4. Cerebral aqueduct (of Sylvius)
5. Fourth ventricle
6. Foramen of Luschka
7. Foramen of Magendie
8. Choroid plexus

L. Meninges

1. Dura mater

a. Extensions of the dura mater
1) Falxcerebri
2) Falxcerebelli
3) Tentorium cerebelli
4) Diaphragmasellae
2. Arachnoid
3. Pia mater

M. Basal ganglia

1. Caudate nucleus
2. Putamen
3. Globus pallidus
4. Claustrum
5. Internal capsule
6. External capsule
7. Extreme capsule

N. Orbit

1. Globe
2. Lens
3. Optic nerve
4. Lacrimal gland
5. Lateral rectus muscle
6. Medial rectus muscle
7. Superior rectus muscle
8. Inferior rectus muscle
9. Superior oblique muscle
10. Inferior oblique muscle
11. Orbital fat
12. Ophthalmic artery
13. Retinal vein

O. Anatomical structures of brain

1. Diploe
2. Subcutaneous soft tissue
3. Superior sagittal sinus (anterior and posterior)
4. Central sulcus
5. Interhemispheric fissure
6. Falxcerebri
7. Centrum semiovale
8. Corpus callosum (genu, rostrum, body and splenium)
9. Septum pellucidum
10. Fornix
11. Sylvian fissure
12. Insula
13. Lentiform nucleus (putamen and globuspallidus)
14. Caudate nucleus (head)
15. Internal capsule (anterior, body and posterior sections)
16. External capsule
17. Claustrum
18. Hippocampus
19. Cerebral peduncles
20. Mammillary bodies
21. Tentorium cerebelli
22. Petrous portion or ridge
23. Cerebellar tonsil
24. Internal auditory canal (IAC)
25. Nasal septum
26. External auditory canal (EAC)
27. Clivus
28. Mastoid air cells.
29. Lines of angulation (imaging baselines) :
    1. Supraorbitomeatal line
    2. Orbitomeatal line

3. Infraorbitomeatal line

Q. Anatomical landmarks

1. Glabella
2. Nasion
3. Acanthion
4. Mental point
5. External auditory meatus (EAM)

R. Neuroanatomy:

1. Introduction and Organization of the Nervous System
2. The Neurobiology of the Neuron and the Neuroglia
3. Nerve Fibers, Peripheral Nerves, Receptor and Effector Endings, Dermatomes, and Muscle Activity
4. The Brainstem
5. The Cerebellum and Its Connections
6. The Cerebrum
7. The Structure and Functional Localization of the Cerebral Cortex
8. The Reticular Formation and the Limbic System
9. The Basal Nuclei (Basal Ganglia) and Their Connections
10. The Thalamus and Its Connections
11. The Hypothalamus and Its Connections
12. The Ventricular System, the Cerebrospinal Fluid, and the Blood-Brain and Blood-Cerebrospinal Fluid Barriers

Section II. Neck

A. Bones

1. Cervical vertebrae

B. Organs

1. Pharynx
2. Larynx
3. Esophagus
4. Trachea
5. Salivary glands
6. Thyroid gland
7. Parathyroid glands
8. Lymph nodes

C. Vasculature and neurovasculature

1. Carotid arteries
2. Vertebral arteries
3. Jugular veins
4. Carotid sheath

D. Musculature

1. Anterior triangle
2. Posterior triangle

Section V. Abdomen

A. Diaphragm and openings

1. Aortic hiatus
2. Caval hiatus

3. Esophageal hiatus

B. Surface landmarks and regions

1. Quadrants
a. Upper left
b. Upper right
c. Lower left
d. Lower right C. Addison's planes (regions)
1. Left hypochondria
2. Epigastric
3. Right hypochondria
4. Left lumbar
5. Umbilical
6. Right lumbar
7. Left iliac
8. Hypo gastric
9. Right iliac

D. Branches of the abdominal aorta

1. Anterior visceral branches
a. Celiac axis
i) Left gastric
ii) Splenic
iii) Hepatic
2. Superior mesenteric
a. Jejunal and ileal
b. Inferior pancreaticoduodenal
c. Middle colic
d. Right colic
e. Ileocolic
3. Inferior mesenteric
a. Left colic
b. Sigmoid
c. Superior rectal
4. Lateral visceral branches
a. Suprarenal
b. Renal
c. Testicular or ovarian
5. Parietal branches
a. Inferior phrenic
b. Lumbar
c. Middle sacral
6. Terminal branches
a. Common iliac

E. Tributaries of the vena cava

1. Anterior visceral
a. Hepatic veins

2. Lateral visceral
a. Right suprarenal
b. Renal veins
c. Right testicular or ovarian
3. Tributaries of origin
a. Common iliac
b. Median sacral

F. Tributaries of the portal vein

1. Splenic
2. Inferior mesenteric
3. Superior mesenteric
a. Left gastric
b. Right gastric
c. Cystic

G. Abdominal organs and structures

1. Bony structures
a. Lumbar vertebrae
2. Abdominal cavity
a. Peritoneum
b. Peritoneal space
c. Retro peritoneum
d. Retroperitoneal space
3. Liver
a. Hepatic arteries
b. Portal venous system 4. Gallbladder and biliary system
5. Pancreas and pancreatic ducts
6. Spleen
7. Adrenal glands 8. Urinary system and tract
a. Kidneys
b. Ureters
9. Stomach
10. Small intestine
11. Colon
12. Musculature

Section III. Pelvis

A. Bony structures

1. Proximal femur
2. Ilium
3. Ischium
4. Pubis
5. Sacrum
6. Coccyx

B. Pelvic vasculature

1. Arterial

a. Common iliac
b. Internal iliac
c. External iliac
d. Ovarian/testicular
2. Venous
a. External iliac
b. Internal iliac
c. Common iliac
d. Ovarian/testicular

C. Pelvic organs

1. Urinary bladder
a. Ureter
b. Urethra
2. Small intestine
a. Terminal ilium and ileocecal valve
3. Colon
a. Ascending
b. Descending
c. Sigmoid
d. Rectum
e. Vermiform appendix 4. Female reproductive organs
a. Vagina
b. Cervix
c. Uterus
d. Fallopian tubes
e. Ovaries
5. Male reproductive organs
a. Testes/scrotum
b. Prostate gland
c. Seminal vesicles
d. External to pelvis

Section IV: Perineum:

1. Symphasis Pubis
2. Coccyx
3. Contents of anal triangle
4. Urogenirtal Triangle
   a. Contents of male urogenital triangle
   b. Contents of female urogenital triangle
5. Greater vestibular glands

Section V:Clinically Oriented Systematic Embryology:

1. **Head & Neck:**
   a. Pharyngeal Arches
   b. Pharyngeal Pouches

c. Pharyngeal Clefts
d. Molecular Regulation of Facial Development Tongue
e. Thyroid Gland
f. Face
g. Intermaxillary Segment
h. Secondary Palate
i. Nasal Cavities
j. Teeth
k. Molecular Regulation of Tooth Development

2. Central Nervous System
a. Spinal Cord
b. Brain
c. Molecular Regulation of Brain Development
d. Cranial Nerves
e. Autonomic Nervous System

3. Digestive system, Body Cavities & Diaphragm:
a. Divisions of the Gut Tube
b. Molecular Regulation of Gut Tube Development
c. Mesenteries
d. Foregut
e. Molecular Regulation of Liver Induction
f. Pancreas
g. Midgut
a. Hindgut

4. Respiratory System:
a. Formation of the Lung Buds
b. Larynx
c. Trachea, Bronchi, And Lungs
d. Maturation of the Lungs

5. Cardiovascular System:
a. Establishment and Patterning of the Primary Heart Field
b. Formation and Position of the Heart Tube
c. Formation of the Cardiac Loop
d. Molecular Regulation of Cardiac Development
e. Development of the Sinus Venosus
f. Formation of the Cardiac Septa
g. Formation of the Conducting System of the Heart
h. Vascular Development
i. Circulation Before and After Birth

6. Urogenital System:
a. Urinary system
b. Genital system

7. Eye & Ear:
a. Optic Cup and Lens Vesicle
b. Retina, Iris, and Ciliary Body
c. Lens
d. Choroid, Sclera, and Cornea
e. Vitreous Body
f. Optic Nerve

g. Molecular Regulation of Eye Development
h. Inner ear
i. Middle ear
j. Extenal ear

Recommended Readings:

1:- Clinical Anatomy by Richard S. Snell
2:-Clinical Neuroanatomy by Richard S. Snell
3:- Clinically oriented Anatomy by Keith L.Moore
4:- Lasts Anatomy by R.M.H McMinn
5:-Atlas of human anatomy by Frank H Natter.
6:- Imaging atlas by Mosby.
7:-Anatomy for diagnostic Imaging by Stephanie Ryan.

PAPER-II RADIATION SCIENCE & TECHNOLOGY

Theory Hours: 150
Practical Hours: 200

This course provides foundation knowledge about general and radiation physics, physical principles of medical imaging, basic information about different imaging modalities, radiation hazards. This course also gives students an understanding of the effects of ionizing radiation on the human body. Typical radiation protection course is a part of this subject.

On completion of this course a student will be able to:

1. Student will be able to discuss basic of physics, atom, electricity& magnetism and Solve numerical
2. Understand &describe X-ray production, radiation interactions with matter
3. Demonstrate the knowledge about radiographic film intensifying screens, grids,beam restricted devices.
4. Compare & contrast radiographic quality & technique.
5. Understand ALARA & calculate radiographic exposure
6. Discuss & apply radiation protection

CONTENTS

Section I.

1. RADIOLOGIC PHYSICS

Concepts of Radiation
Nature of our surroundings
Sources of Ionizing Radiation
Discovery of X-rays
Development of Modern Radiology
Basic Radiation Protection
Definitions
Fundamentals of Physics
Review of Mathematics
Units of Measurement
Mechanics
Heat and Thermodynamics
Waves and Oscillation

2. The Atom

Centuries of Discovery
Combinations of Atoms
Magnitude of Matter
Atomic Structure
Atomic Nomenclature
Radioactivity

3. Types of Ionizing Radiation

Electromagnetic Radiation
Photons Everywhere
Electromagnetic Spectrum
Radiological Important Photons
Energy and Matter

4. Electricity and Magnetism
Electric to Electromagnetic Energy
Electrostatics
Electrodynamics
Magnetism
5. Electromagnetism
Electromagnetic Effects
Electromagnetic Induction
Electric Generators and Motors
The Transformer
Rectification

Section-II

1. The X-ray Machine
Shapes and Sizes
X-ray Tube
Operating Console
High-Voltage Section
X-ray Tube Rating Charts
2. X-ray Production
Electron-Target Interaction
X-ray Emission Spectrum
Factors Affecting the X-ray Emission Spectrum
3. X-ray Emission
X-ray Quantity
X-ray Quality
4. **X-ray Interaction with Matter**
Five Basic Interactions
Differential Absorption
Contrast Examinations
Exponential Attenuation
5. Radiographic Film
Film Construction
Different types of films
Film storage and handling
Formation of Latent Image
Handling and Storage of Films
Optical density: characteristic curve
Film speed; Film contrast latitude
6. Processing the Latent Image
Evolution of Film Processing
Processing Chemistry
Automatic Processing
Alternative Processing Methods
7. Intensifying Screens
Screen Construction
Luminescence
Screen Characteristics

Screen-Film Combinations
Care of Screens
8. Beam-Restricting Devices
Production of Scatter Radiation
Control of Scatter Radiation
9. The Grid
Control of Scatter Radiation
Characteristics of Grid Construction
Measuring Grid Performance
Types of Grids
Use of Grids
Grid Selection
Types of filters; internal and external
10. Radiographic Quality
Film Factors
Subject Factors
Considerations for Improved
Radiographic Quality
1. Radiographic Exposure
Milliamps
Kilovolts Peaks
Exposure Time
Milliampere-Seconds
Distance
Imager Characteristics
2. Radiographic Techniques
Patient Factors
Image Quality Factors
Radiographic Technique Charts
Automatic Exposure Techniques
3. Introduction to Therapeutic Radiology
Therapeutic Radiology
Gamma Radiations and Other ionizing Radiotherapy
11. Radiographic Artifact
12. Radiographic Quality Control

Section-III

RADIATION PROTECTION
1. Fundamental Principles of Radiobiology
From Molecules to Humans
Human Biology
Law of Bergonie and Tribondeau
Physical Factors Affecting Radio sensitivity
Biologic Factors Affecting Radiosensitivity
Radiation Dose-Response Relationships
2. Molecular and Cellular Radiobiology
Irradiation of Macromolecules
Radiolysis of Water
Direct and Indirect Effect

Cell Survival Kinetics
LET, RBE, and OER

3. Early Effects of Radiation

Acute Radiation Lethality
Local Tissue Damage
Hematologic Effects
Cytogenetic Effects

4. Late Effects of Radiation

Local Tissue Effects
Life Span Shortening
Risk Estimates
Radiation-Induced Malignancy
Total Risk of Malignancy
Radiation and Pregnancy

5. Health Physics

Cardinal Principles of Radiation
Protection
Maximum Permissible Dose
X-rays and Pregnancy

6. Design of Radiologic Imaging Facilities

Designing Team
Departmental Activity
Location of X-ray Department
Plan Layout
Construction Considerations

7. Designing for Radiation Protection

Design of X-ray Apparatus
Design of Protective Barriers
Radiation Detection and Measurement

8. Radiation Protection Procedures

Occupational Exposure
Patient Dose
Reduction of Occupational Exposure
Reduction of Unnecessary Patient Dose

Recommended Books:

1:- Radiologic Sciences for Technologists by Stewart C. Bushong .
2:-The Essential Physics of Medical imaging by Bushberg.
3:- Quality assurance work for radiographers and radiologic Technologist by Peter J Lioyd.
4:- Instruction Manual for Bushong by TM. Series
5:- Christensen;s Physics for Diagnostic Radiology by Thomas S. Curry.
6:- Farr's Physics for Medical Imaging by Penelope Allisy-Robe

Paper-III GENERAL RADIOLOGY

Theory Hours: 150
Practical Hours: 300

Description
Content provides the knowledge base necessary to perform standard Radiographic procedures. Consideration is given to the evaluation of optimal diagnostic images.

(OBJECTIVES)

◆Describe standard positioning terms.

◆Demonstrate proper use of positioning aids.

◆Discuss general procedural considerations for radiographic exams.

◆Identify methods and barriers of communication and describe how each may be used or overcome effectively during patient education.

◆Explain radiographic procedures to patients/family members.

◆Modify directions to patients with various communication problems.

◆Develop an awareness of cultural factors that necessitate adapting standard exam protocols.

◆Adapt general procedural considerations to specific clinical settings.

◆Identify the structures demonstrated on routine radiographic images.

◆Simulate radiographic procedures on a person or phantom in a laboratory setting.

◆Evaluate images for positioning, centering, appropriate anatomy and overall image quality.

◆Discuss equipment and supplies necessary to complete basic radiographic procedures.

◆Explain the routine and special positions/projections for all radiographic procedures.

◆Apply general radiation safety and protection practices associated with radiography

Contents

Section I. Standard Terminology for Positioning and Projection

A. Standard terms

1. Radiographic position
2. Radiographic projection
3. Radiographic view

B. Positioning terminology

1. Recumbent
2. Supine
3. Prone
4. Trendelenburg
5. Decubitus
6. Erect/upright
7. Anterior position

8. Posterior position
9. Oblique position

C. General planes

1. Sagittal or midsagittal
2. Coronal or midcoronal
3. Transverse
4. Longitudinal

D. Skull lines

1. Glabellomeatal line
2. Interpupillary line
3. Orbitomeatal line
4. Infraorbitomeatal line
5. Acanthiomeatal line
6. Mentomeatal line

E. Skull landmarks

1. Auricular point
2. Gonion (angle)
3. Mental point
4. Acanthion
5. Nasion
6. Glabella
7. Inner canthus
8. Outer canthus
9. Infraorbital margin
10. Occlusal plane
11. External auditory meatus
12. Mastoid tip

F. Terminology of movement and direction

1. Cephalic/caudal
2. Inferior/superior
3. Proximal/distal
4. Plantar/palmar
5. Pronate/supinate
6. Flexion/extension
7. Abduction/adduction
8. Inversion/eversion
9. Medial/lateral

G. Positioning aids

1. Sponges
2. Sandbags
3. Immobilization devices

H. Accessory equipment

1. Calipers
2. Lead strips
3. Lead shields or shadow shields
4. Lead markers

5. Image receptor holders

Section II. General Considerations

1. Patient identification
2. Verification of procedure(s) requested
3. Review of clinical history
4. Clinical history and patient assessment
a. Role of the radiographer
b. Questioning skills
c. Chief complaint
d. Allergy history
e. Localization
f. Chronology
g. Severity
h. Onset
i. Aggravating or alleviating factors
j. Associated manifestations
k. Special considerations
5. Exam sequencing

B. Room preparation

1. Cleanliness, organization and appearance
2. Necessary supplies and accessory equipment available

Section III. Patient Considerations

A. Establishment of rapport with patient

1. Patient education
a. Communication
b. Common radiation safety issues and concerns
2. Cultural awareness
3. Determination of pregnancy

B. Patient preparation

1. Verification of appropriate dietary preparation
2. Verification of appropriate medication preparation
3. Appropriate disrobing and gowning
4. Removal of items that may cause artifacts

C. Patient assistance

D. Patient monitoring

E. Patient dismissal

Section IV. Positioning Considerations for Routine Radiographic Procedures

A. Patient instructions

B. Image analysis

1. Patient positioning
2. Part placement
3. Image receptor selection and placement
4. Beam-part-receptor alignment
5. Beam restriction and shielding

C. Special considerations

1. Atypical conditions

2. Trauma Radiography
3. Pediatric Imaging.
4. Geriatric Radiography
5. Mobile Radiography.
6. Surgical Radiography
7. Tomography.
8. Introduction to Computed Radiography
& Digital Radiography

D. Special needs patients

1. Trauma
2. Obesity
3. Cultural awareness
4. Claustrophobia

E. Positioning for the following studies:

1. Skeletal system
a. Upper extremity
1) Fingers
2) Hand
3) Wrist
4) Forearm
5) Elbow
6) Humerus
b. Shoulder
1) Shoulder joint
2) Scapula
3) Clavicle
4) Acromioclavicular articulations
c. Lower extremity
1) Toes
2) Foot
3) Ankle
4) Calcaneum
5) Tibia/fibula
6) Knee
7) Patella
8) Femur
d. Pelvic girdle
1) Pelvis
2) Hip
e. Vertebral column
1) Cervical
2) Thoracic
3) Lumbar
4) Sacrum
5) Coccyx
6) Sacroiliac articulations

7) Scoliosis survey
f. Bony thorax
1) Ribs
2) Sternum
3) Sternoclavicular articulations
g. Cranium
1) Skull
2) Facial bones
3) Nasal bone
4) Orbits/optic foramina
5) Zygomatic arches
6) Mandible
7) Temporomandibular articulations
8) Paranasal sinuses
h. Special studies
1) Bone survey
2) Long bone measurement
3) Bone age
4) Foreign body
2. Respiratory system
a. Upper airway
b. Chest
3. Abdominal viscera
a. Abdomen and GI
b. Urological studies

Section V. DARK ROOM

Need for good darkroom procedures andnecessity for proper darkroom construction.
Darkroom construction and equipment –Theory of the photographic process, Safe
Light photographic process fundamentals; Construction of film; handling. Density Ratio,
Constituents of Darkroom
Chemistry; Developer, Fixer
Automatic processing:
Differences between manual and automatic processing.
Types and care of processing apparatus, film artifacts and their causes.

Recommended Readings:

1:- Radiographic Positioning by Eisenberg.
2:- Merrill atlas of radiography positioning and radiologic procedure by Philip W Ballinger.
3:- Clarke positioning in radiography by Clarke.
4:- Reference book of atlas of diagnostic imaging by Professor Dr. Mohammad Tariq.
5:- Radiological Positioning. Bell & Finley

PAPER-IV MAMMOGRAPHY & SPECIAL RADIOLOGICAL TECHNIQUES

Theory Hours: 150
Practical Hours: 200

Description

Content provides the knowledge base necessary to perform standard mammography, Fluoroscopic and special Radiologic studies. Consideration is given to the evaluation of optimal diagnostic images. Student technologist will complete Log Book of all activities of clinical rotation under the supervision of an experienced Radiologist/Technologist and will show log book to external examiner in presence of his teacher (internal Examiner). The core of this course is clinical skills to acquire Images by using patient required technology, Knowledge of safe practice, understanding of Image about normal and abnormal conditions, and professional attitude in accordance with the scope of profession.

(OBJECTIVES)

◆Discuss general procedural considerations for radiographic / Fluoroscopy exams.

◆Explain procedures to patients/family members.

◆Modify directions to patients with various communication problems.

◆Develop an awareness of cultural factors that necessitate adapting standard exam protocols.

◆Adapt general procedural considerations to specific clinical settings.

◆Identify the structures demonstrated on routine radiographic and fluoroscopic images.

◆Adapt radiographic and fluoroscopic procedures for special considerations.

◆Simulate radiographic and fluoroscopic procedures on a person or phantom in a laboratory setting.

◆Evaluate images for positioning, centering, appropriate anatomy and overall image quality.

◆Discuss equipment and supplies necessary to complete basic Mammography and fluoroscopic procedures.

◆Explain the patient preparation necessary for various contrast and special studies.

◆Apply general radiation safety and protection practices associated with Procedures

Contents:

Section-I

General and Procedural Considerations for mammography

A. Equipment and Technical Considerations
B. Anatomy & Clinical consideration
C. Mammography projections & Positioning
D. Significant mammographic findings & Related Pathology

F. Quality control
G. Radiation dose considerations in mammography
H. Introduction to different biopsy

Section-II

Procedural Considerations for Contrast Studies

A. Equipment and materials needed
B. Contrast media
1. Purpose
2. Types
a. Negative agents
1) Carbon dioxide
2) Air
3) Nitrous oxide
b. Positive agents
1) Barium sulfate
2) Iodinated
C. General procedure and follow-up care
D. Patient and body part positioning
E. Structures and functions demonstrated
F. Positioning for GI and genitourinary (GU) procedures
1. Digestive system
a. Single and double contrast examinations
1) Upper gastrointestinal system
2) Lower gastrointestinal system
b. Swallowing dysfunction study
c. Small bowel
2. Biliary system
a. Endoscopic retrograde cholangiographic pancreatography (ERCP)
b. Cholangiography
1) Operative cholangiography
2) T-tube cholangiography
3. Genitourinary system
a. Intravenous urography
b. Retrograde urography
c. Cystography and cystourethrography
d. Hysterosalpingography
G. Procedural considerations for the following special studies:
1. Arthrography
2. Myelography
3. Sinograms + Fistulograms; Loopograms
4. Sialuography
5. Dacryo-cystography
6. Bronchography
C.M.P (Clinical Management Practice) Clinical Internship Mammography

Section-III

Fluroscopy

Visual Considerations
Instrumentation of Fluoroscopy
Practical Fluoroscopic Technique
Fluoroscopic Image Monitoring
Digital Fluoroscopy

Section-IV

Special x-ray imaging

Select Plane-Film Procedures
Tomography'
Stereoradiography
Magnification Radiography
Digital Radiographic Imaging (DRI/CRI System)
Digital Radiography or Computerized Radiographic Imaging
Quality Control
Artifacts

Recommended Readings:

1:- Atlas of Mammographic Positioning by Lucinda.
2:- Radiologic sciences for technologists by Stewart C. Bushong.
2:- A guide to radiologic procedure by Chapman.
3:-Merrill atlas of radiography positioning and radiologic procedure by Philip W Ballinger.
4:- Fluoroscopy Notes by TM series.
5:- Textbook of Radiology & Imaging by David Sutton, Rodney Reznek & Janet Murfitt.
6:- Clinical Radiology made ridiculously simple Atlas by Hugue Oulettue, Ara Kassarjian & Patrice Tetreault.

PAPER V- CLINICAL PHARMACOLOGY

Theory Hours=120
Practical hours=60

Description
Content provides basic concepts of pharmacology, venipuncture and administration of diagnostic contrast agents and intravenous medications. The appropriate delivery of patient care during these procedures are emphasized.

Considerations
Though regulations regarding the administration of contrast media and intravenous medications vary between countries and institutions, the position of the Imaging Technologists is that venipuncture falls within the radiologic technology profession's general scope of practice and practice standards. Therefore, it is included in the didactic and clinical curriculum included with demonstrated competencies in all appropriate disciplines regardless of the country or institution where the curriculum is taught. In states or institutions where students are permitted to perform intravenous injections, the program has specific ethical and legal responsibilities to the patient and the student. The student shall be assured that:

- Adequate supervision will be provided.
- Evaluation and demonstration of competency occur before venipuncture is performed unsupervised.

Objectives

- Distinguish among the chemical, generic and trade names for drugs in general.
- Describe pharmacokinetic and pharmacodynamic principles of drugs.
- Explain the uses and impact of drug categories on the patient.
- Define the categories of contrast agents and give specific examples for each category.
- Explain the pharmacology of contrast agents.
- Describe methods and techniques for administering various types of contrast agents.
- Identify and describe the routes of drug administration.
- Demonstrate appropriate venipuncture technique.
- Differentiate between the two major sites of intravenous drug administration.
- Identify, describe and document complications associated with venipuncture and appropriate actions to resolve these complications.
- Discuss the various elements of initiating and discontinuing intravenous access.
- Differentiate and document dose calculations for adult and pediatric patients.
- Prepare and perform injection of contrast agents/intravenous medications using aseptic technique.

Contents:

The Evolution of Medical Drugs

- U.S. Pharmacopeia
- Drug Origins and Sources
- The Food and Drug Administration (FDA)
- British Pharmacopeia

Section I. Drug Nomenclature
A. Chemical name
B. Generic name
C. Trade name
Section II. Methods of Drug Classification
A. Chemical group
B. Mechanism/site of action
C. Primary effect
Section III. General Pharmacologic Principles
A. Pharmacokinetics
B. Pharmacodynamics
Section IV. Six Rights of Drug Safety
A. The right medication
B. The right dose
C. The right patient
D. The right time
E. The right location
F. The right documentation
Section V. Drug Categories of Relevance to Radiography (Uses and Impacts on Patient)
A. Analgesics
B. Anesthetic agents
C. Antiallergic and antihistamine drugs
D. Antianxiety drugs
E. Antiarrhythmic drugs
F. Antibacterial drugs
G. Anticoagulant and coagulant drugs
H. Antidepressants
I. Antiemetic drugs
J. Antihypertensive drugs
K. Anti-inflammatory drugs
L. Antiseptic and disinfectant agents
M. Bronchodilators
N. Cathartic and antidiarrheal drugs
O. Diuretics
P. Sedative and hypotonic drugs
Q. Vasodilators and vasoconstrictors
Section VI. Contrast Agents
A. Types of compound
1. Metallic salts
2. Organic iodides
a. Ionic contrast agents
b. Nonionic contrast agents
3. Gaseous
4. Oils: Myelograms, sinuses
5. Tablets: cholecystograms

B. Beam attenuation characteristics
1. Radiolucent (negative)
2. Radiopaque (positive)
3. Impact of atomic number
C. Pharmacologic profile of contrast agents
1. Chemical composition
2. Absorption characteristics
8. Patient reactions
D. Dosage
E. Preparation

Section VII. Routes of Drug Administration

A. Systemic
1. Oral
2. Rectal
3. Tube/catheter
4. Inhalation
B. Parenteral
1. Intravenous
2. Intra-arterial
3. Intrathecal

Section VIII. Venipuncture

A. Methods
1. Continuous infusion
2. Intermittent infusion
3. Direct injection
a. Hand injection
b. Mechanical pressure injector
B. Sites of administration
1. Peripheral
2. Central
C. Complications
1. Infiltration
2. Extravasation
3. Phlebitis
4. Air embolism
5. Drug incompatibility
6. Low fluid level in container
D. Venipuncture procedures
1. Equipment
2. Patient identification, assessment and instructions
3. Informed consent
a. Adults
b. Pediatric patients
5. Patient preparation
6. Application of standard precautions
7. Procedure

a. Injection through an existing line
b. Venipuncture
8. Site observation

Recommended Readings:

1. Katzung and Trevors Pharmacology Examination & Board review.
2. Lippincott illustrated Reviews of Pharmacology.
3. Chapman's Guide to Radiologic Procedures

Third Professional BSc Hons. Medical Imaging Technology

Paper I Paper II: ULTRASOUND & ECHOCARDIOGRAPHY

Theory Hours: 150
Practical Hours: 200

Objectives:
At the end of this course the student shall be able to:
1. Express the knowledge of ultrasound physics.
2. Explain the production, Properties and shapes of Beam.
3. Describe A, B, M modes.
4. Understand and explain three & four dimensional Techniques.
5. Explain Doppler techniques their use and function.
6. Demonstrate and express, range of application, Patient preparation, patient positioning.
7. Demonstrate the, use and Adjustment of the equipment, use of Coupling agents.
8. Explains general indications (B-scan and duplex techniques).
9. Explains Guidelines for the examination.
10. Understands and demonstrate Documentation.
11. Demonstrate Understanding of the ultrasound image.
12. Understand and explain Interventional Ultrasound.
13. Name and brief description of Interventional Procedures.

Contents:

Section I-Basic physics

Definitions
Generation of ultrasound
Properties of ultrasound
Shape of the ultrasound beam
Spatial resolution
Echo Doppler effect
Ultrasound techniques
A-mode
B-mode
M-mode or TM-mode
B-scan, two-dimensional
Three- and four-dimensional techniques
B-flow
Doppler techniques
Contrast agents
Artifacts
Adverse effects
Ultrasound Elastography
Quality Control of Ultrasound Equipment.

Section II-Examination technique: general rules and recommendations

Range of application

General indications (B-scan and duplex techniques)
Preparation
Positioning
Coupling agents
Equipment (Ultrasound)
Adjustment of the equipment
Guidelines for the examination
Documentation
Interpretation of the ultrasound images
Duplex technique

Section III-Application of Ultrasound for following regions and organs

Abdominal cavity and retroperitoneum
Liver
Gallbladder and bile ducts
Pancreas
Spleen
Gastrointestinal tract
Adrenal glands
Kidneys and ureters
Urinary bladder, urethra, prostate and seminal vesicles and penis
Scrotum
Special aspects of abdominal ultrasound
Gynecology
Normal findings
Uterus & Tumors of uterus
Ovaries
Diagnosis of early Pregnancy
Biometry of First, Second and third trimester.
Placental location and fetal gender
Diagnosis of fetal malformation.
Sonomammography.
Thyroid imaging.
Identification of normal and abnormal patterns on Doppler of: Upper limb & Lower limb arterial & Venous, Hepatic, Portal, Renal & Carotid Doppler.

Section IV-Interventional Ultrasound

General Definitions
Ultrasound-guided procedures: general clinical rules
Diagnostic procedures
Therapeutic procedures
Complications of interventional Ultrasonography

Practical Training:

Liver, Gallbladder, Biliary Ducts, Pancreas
Adrenal Gland, Kidneys, Urinary Bladder,
Renal Tract, Spleen and Gynecological
New Imaging Techniques, breast, thyroid.
Obstetrical

Artifacts
C.M.P (Clinical management practice)
Clinical internship of ultrasound

Section V- ECHOCARDIOGRAPHY:

Theory:

Basic Principles of 2-D / M-Mode
Echocardiography.
Echocardiography Equipment
Basics
Advances applications
Principles of Doppler Echocardiography
CW/PW
Color Doppler
Fundamentals of cardiac anatomy in relevance to echocardiography
Performance of Echocardiography
Echocardiography windows
Operational modes
Pediatric Echocardiography
Basic Principles
Segmental sequential analysis
Physiological aspects of Echocardiography
Ventricular Function
Diastolic Function
Flows / Pressures / Shunts
Advanced Echocardiography – after passing exam in internship
TOE (Trans-esophageal Echocardiography)
Pre-operative Echocardiography
Fetal Echocardiography
3D / 4D Echocardiography
Flows / Pressures / Shunts

Practical:

Understanding of Echocardiography equipment
Operationalization of Echocardiography /
Doppler Machine
Training in performance of a standard Echocardiography in Adult & Pediatric patients.
LV Function assessment
Observation of advanced Echocardiography
TOE
Fetal
Per operation
3D/4D
Brief of: Valvular Heart Diseases

Recommended Readings:

Ultrasound;-

1:- The Requisites: Ultrasound. Barbara S. Hertzberg, William D. Middleton

2:- Ultrasound teaching manual: The basics of Performing and Interpreting ultrasound Scans by Mathias Hofer.
3:- Ultrasound by sounders.
4:- Color atlas of ultrasound anatomy by Berthold Block, M.D.
5:-Manual of ultrasound by WHO.
6:- Teaching Manual of Color Duplex Sonography by Mathias Hofer.
7:- Clinical Doppler Ultrasound, Myron A. Pozniak, Paul L Allan.
8:- Textbook of Radiology & Imaging by David Sutton, Rodney Reznek & Janet Murfitt.
9:- Interventional Ultrasound: A Practical guide & Atlas by Christophe F. Dietrich &Dieter Neurenberg, Thieme Publishers.

Echo books:
1:- Echo made easy by Jaypee.
2:- Echo made easy by Samkadura

Paper-II: COMPUTED TOMOGRAPHY (CT)

Theory Hours: 150
Practical Hours: 310

The intention of this course of Computed Tomography is to provide necessary knowledge and to develop cognitive skills underlying the performance of the tasks typically required of entry level CT technologists in this specialized area. The course of Computed tomography shall consist of two main parts theoretical teaching and Practical training which covers lab work and on patient supervised clinical hands on training. Student technologist will complete Log Book of all activities of clinical rotation under the supervision of an experienced CT Tech and will show log book to external examiner in presence of his teacher (internal Examiner). The core of this course is clinical skills to acquire Images by using patient required technology, Knowledge of safe practice, understanding of Image about normal and abnormal conditions, and professional attitude in accordance with the scope of profession.

OBJECTIVES:

◆Understands & explain the hardware and generation of CT

◆Explain the difference between reconstructing and reformatting an image.

◆Cite the structures demonstrated on commonly performed CT images.

◆Simulate commonly performed CT procedures on a person or phantom.

◆Understands & explain Common indications and contra indications for CT exam requested

◆Evaluate images for positioning, centering, appropriate anatomy and overall image quality.

◆Discuss equipment and supplies necessary to complete commonly performed CT procedures.

◆Explain the CT acquisition protocol for commonly performed head/neck, thorax and abdomen procedures.

◆Explain the patient preparation necessary for commonly performed CT contras studies.

◆Name the type, dosage purpose, and route of contrast administration for common CT procedures.

◆Understand the complications of Contrast media explain precautions & take necessary steps for prevention.

◆Explain the patient safety and patient education about CT Procedure

◆Explain patient care in Radiology in general and in CT specific.

Contents:

Section I-Patient Care

Patient Communication
Patient Preparation
Contrast Agents
Injection Techniques
Radiation Dosimetry in CT

Section II-Cross-Sectional Anatomy & Basic Pathology (CT Images)

Neuroanatomy and Related Pathologies.
Thoracic Anatomy and Related Pathologies
Abdomino-pelvic Anatomy and Related Pathologies
Musculoskeletal Anatomy and Related Pathologies
Abdomen and Pelvis Imaging Procedures
Musculoskeletal Imaging Procedures
Interventional CT and CT Fluoroscopy
PET/CT Fusion Imaging

Section III-Physics and Instrumentation

Basic Principles of CT
Data Acquisition
Image Reconstruction
Image Display
Methods of Data Acquisition
Image Quality
Quality Assurance
Post-Processing
Data Management

Section IV-Imaging Procedures and Protocols

Neurologic Imaging Procedures
Thoracic Imaging Procedures
Abdomen and Pelvis Imaging Procedures
Musculoskeletal Imaging Procedures
Interventional CT and CT Fluoroscopy
PET/CT Fusion Imaging

Bone Densitometry:

Highlight different bone densitometry techniques. While focusing on Dual Energy X-Ray Absorptiometry (DEXA), also considers other densitometry methods for both axial and peripheral measurements.
Quality control issues and statistical interpretation of results relevant toDEXA

Recommended reading:

1. Computed Tomography for Technologists A Comprehensive Text: by Lois Romans.
2. CT Teaching Manual by Matthias Hofer
3. Computed Tomography for Radiographers 1986. By: Malcolm J. Broker.
4. All about Computed tomography A Technologist guide T.M Series.
5. Radiologic Procedures by Chapman
6. Textbook of Radiology & Imaging by David Sutton, Rodney Reznek & Janet Murfitt.
7. Clinical Radiology made ridiculously simple Atlas by Hugue Oulettue, Ara Kassarjian & Patrice Tetreault.
8. Anatomy for Diagnostic Imaging. Stephanie Ryan, Michelle McNicholas, Stephen J. Eustace.
9. Diagnostic Imaging: Andrea G. Rockall, Andrew Hatrick, Peter Armstrong, Martin Wastie
10. Dual Energy X-Ray Absorptiometry for Bone mineral Density & Body Composition Assessment by IAEA.

Paper III MEDICAL SOCIOLOGY

Theory Hours: 120

Description

What makes medical sociology important is the critical role social factors play in determining or influencing the health of individuals, groups, and the larger society. Social conditions and situations not only promote and, in some cases, cause the possibility of illness and disability, but also enhance prospects of disease prevention and health maintenance. Since its inception, work in medical sociology was oriented toward finding solutions relevant to clinical medicine. Medical sociology has evolved to the point today that it investigates health and medical problems from an independent sociological perspective. This makes the work of medical professionals socially approved and acceptable.

- Social Problems and Policies: Provides an introduction to sociology through an in-depth study o a major social problem; explores policy implications of the general sociological perspective and of sociological knowledge of a particular problem. Topics have included: childhood as a social problem, sociology of money, medicine.
- Current Social Controversies: Selected controversies, their history, sociological evidence, solutions being debated in the country and abroad, and the likely outcome of policies. Controversies such as population and the environment, war, childhood, poverty, and education will be examined.
- Envisioning the City: Students conduct field research in a city in order to understand the relationship between the built environment and social problems such as obesity and residential segregation. Addresses approaches to resolving these problems through community action.
- Social Problems: Understands current social problems, causes and consequences using a sociological framework
- The Economy, Organization, and Work: Explores the transformation of capitalism and industrialized societies, the evolution of organizations, government agencies, educational systems, and others, and the changing world of work.
- Social Change: Introduction to theoretical and empirical studies of social change. Explores issues such as modernization; rationalization; demographic, economic, and religious causes of change; and reform and revolution.
- Social Inequality: Why are income, wealth and status distributed unequally? Is social inequality good for society? Explores the economic basis of social class, education and culture; social mobility; social inequality in comparative and historical perspective.
- Culture and Society: Explores changing beliefs about the role of ideas, values, and symbols in society. Considers recent public debates over the content and practices of science, morality, art, and popular culture.
- Society and the Individual: Introduction to the concepts, perspectives, and theories of social psychology from the level of the individual to collective behavior.

Objectives:

On completion of this course a student will:

1. Understand problems of society related to profession and resolve these at their own level
2. Be able to resolve social and medical controversies
3. Have a fresh outlook, by having an orientation towards social and medical research
4. In modern complex world, the sociological perspective, attains importance for professionals
5. Understand the dynamism of ever changing world, students are trained to adopt these changes, having a hold on the medical knowledge, not contrasting to the values of society

6. Work in line with the desirability of culture and society with their professional mobility
7. Have knowledge and create a connection between individual (professional) and society

Contents

General Sociology:

1. Introduction to sociology
2. Subject Matter
3. Scope of Sociology
4. Scientific Observation
5. The Scientific Method
6. Sociology for professionals
7. Importance of sociology in MIT

Social Processes:

1. Sociology as Science
2. Cooperation
3. Competition
4. Conflict

Human Group and Society:

1. Definition of Group
2. Types of Groups
3. Importance of Group
4. Definition of Culture
5. Types of Culture

Human Social Behavior (Values and Norms):

1. Definition of Social Norms
2. Types
3. Definition of Social Sanctions
4. Types
5. Importance of Social Norms and Sanctions

Socialization and Personality:

1. Foundation of Personality
2. Heredity and Personality
3. Environment and Personality
4. Interaction of Heredity and Environment
5. Socialization
6. Maturation
7. Forms of Learning
8. Socialization and Personality
9. Social Group Processes and Integration of Personality

Social Institutions (With the stress on Sociology of Family):

1. Definition
2. General Functions of Social Institutions
3. Family
4. Education and Health
5. Religion
6. Economics
7. Govt. Justice and Politics

Social Change (Modernization):

1. Definition
2. Theories of Social Change
3. Agents of Social Change
4. Factors of Social Change
5. Resistance to Social Change
6. Social Planning and Social Change

Social Mobility and Adaptation:

1. Definition
2. Factors Causing Social Mobility
3. Types of Social Mobility
4. Social Mobility and Society

Medical Sociology:

1. Defining Health
2. Social Ideas about Health and Social Behavior
3. Development of Medical Sociology
4. Health Care: A Right or Privilege

Epidemiology:

1. Measures
2. Development of Epidemiology
3. Disease and modernization

Social Demography:

1. Age, Gender and Race
2. Socioeconomic Status

Stress and Social Behavior:

1. Sociologist's Contribution
2. Stress
3. Social Factors and Stress

Health Behavior:

1. Life Style and Health
2. Preventive Care
3. Illness Behavior

The Sick Role:

1. Illness and Deviance
2. The Functionalist approach to Deviance
3. The Sick Role
4. Criticism of the sick Role
5. Being Sick and Disable

Hospital as institutions of Health:

1. Development of Hospitals as Social Institutions
2. Hospitals in Pakistan
3. The organization of General Hospitals
4. The Hospital – Patient Role
5. The Rising Cost of Hospitalization
6. The Role of Medical Imaging Professionals in Hospitals

Recommended Readings:

1. David Tucket (ed) 1976. An Introduction to Medical Sociology; London, Tavistock Publication.

2. Moon graham, 1995, Society And Health; An Introduction to Social Science For Professionals, London; Rutledg
3. Dr. Saadat Faruq, 1999, Introduction to Medical Sociology, Azeem Publishers and book sellers, Urdu Bazar, Lahore

Paper IV-SURGERY

Theory Hours: 100

Description

Content focuses on the manifestations of surgical conditions, indications and role of medical imaging procedures and general overview of a verity of surgical conditions.

Objectives

At the end of this Module the student of MIT will be able to:

1. Define terminology used in the study of Surgery.
2. Describe the general principles and mechanisms of surgical conditions.
3. Describe the common etiology, signs and symptoms and diagnostic tests applicable in surgical conditions.
6. Describes Indications of Imaging Procedures in selective surgical conditions.
7. Start relevant imaging investigations and general outcomes of those.

Contents

1. Introduction to surgery

- Importance and Role Of Imaging In Surgical Conditions
  Surgical process
- Introduction to Diagnostic process

2. Arterial Disorders

- Arterial stenosis or occlusion
- Acute arterial occlusion and Arterial dilation
- Aortic aneurysm

3. Venous Disorders

- Venous incompetence varicose veins
- Venous thrombosis

4. **Musculoskeletal Disorders**

- Fractures of bones
- Dislocations of joints
- Compound & Simple Fracture Describing a dislocation or fracture
- Complications of fracture / dislocation.

5. The Breast.

- Investigation of the breast diseases.
- Benign breast disease.
- Malignant tumors of the breast.

6. The Cranium.

- Head and Brain injury.

- Hydrocephalus.
- Intracranial tumors
- Subarachnoid hemorrhage and aneurysms.

7. Diseases of the Gastrointestinal Tract:

- Congenital abnormalities of the GIT.
- Foreign bodies in the esophagus and lungs.
- Corrosive injury of esophagus.
- Stones and Stricture in the bile duct.
- Acute Abdomen
- Small & Large bowel obstruction
- Ulcerative colitis,
- Crohn disease,
- Hirshprung diseases,
- Tumors of bowel,
- Appendicitis.
- Gall stones,
- TIPSS,
- Portal hypertension
- Liver tumors,
- Cholelithiasis, Choledocolithiasis
- GB tumors.
- Pancreatitis,
- Pancreatic tumors,
- Peritonitis,
- Peritoneal tumors.
- Ascites,
- Abdominal trauma.
- Hernias.

8. **Diseases of the Genitourinary System**:

- Imaging investigations of the genital tract Congenital abnormalities of kidneys and renal tract Hydronephrosis.
- Renal, Ureteric and Bladder calculi.
- Rupture of the bladder.
- Kidney Infections
- Urethral stricture.
- Varicocele and Hydrocele.
- Cystic diseases
- . Abscess formation
- Trauma to kidneys.
- Trauma to Bladder
- Neoplasms of the Genitourinary system

9. Nervous system*:*

- Cerebrovascular disease
- Tumors

10. Trauma:

- Shock & its Types**.**
- Triage
- Role of imaging in trauma
- Handling of patients in traumatic conditions.

RECOMMENDED BOOKS

1. Short Practice of Surgery by Bailey and Love's
2. Text Book of Surgery by Ijaz Ahsan.
3. General surgery by Abdul Wahab Dogar

Paper-V MEDICINE

Theory Hours: 100
Practical Hours: 100

Description

Content focuses on the characteristics and manifestations of Medical Conditions to the structure or function of the body.

Objectives

1. Define terminology used in the study of Medicine.
2. Describe the general principles and mechanisms of disease.
3. Describe the common etiology, signs and symptoms, diagnostic tests.
4. Briefly Describes management of common diseases and disorders of body systems.
6. Describes Indications of Imaging Procedures in selective Medical conditions.

Contents:

1. DISEASES OF THE CARDIOVASCULAR SYSTEM:

a. Investigation of the cardiovascular disease.

b. Heart failure.

c. Hypertension.

d. Myocardial ischemia.

e. Valvular heart diseases

   i. Mitral valve disease.
   ii. Aortic valve disease.
   iii. Tricuspid valve disease.

f. Congenital heart diseases

   i Persistent ductusarteriosis
   ii Coarctation of the aorta.
   iii Arterial septal defect.
   iv Ventricular septal defect.
   v Tetralogy of fallot.

g. Cardiac tumors.

2. DISEASES OF THE RESPIRATORY SYSTEM.

a. Investigation of the respiratory disease.

b. Pneumonia.

c. Tuberculosis.

d. COPD

e. Primary & Secondary tumors of the lungs.

f. Tumors of the mediastinum.

g. Diseases of the pleura.

h. Deformities of the chest wall.

3. DISEASES OF THE KIDNEY AND URINARY SYSTEM.

a. Investigation of the renal disease.

b. Acute and chronic renal failure

c. Cystic kidney disease.

d. Obstruction of the urinary tract.

e. Urinary tract calculi and nephrocalcinosis.

f. Tumors of the renal pelvis, kidney, ureter and bladder

g. Prostatic disease.

4. ENDOCRINE DISEASES.

a. Imaging Investigation of the endocrine disease.

b. Goiter.

c. Diabetic mellitus

d. Hypothyroidism

e. hyperthyroidism,

f. Cushing syndrome

g. MEN1 & MEN2**.**

5. DISEASES OF THE ALIMENTARY TRACT.

a. Investigation of gastrointestinal disease.

b. Dysphagia.

c. Tumors of the esophagus.

d. Perforation of the esophagus.

e. Peptic ulcer disease.

f. Inflammatory of bowel loops.

g. Tumors of the stomach and small intestine.

h. Tumors of the pancreas.

6. DISEASES OF THE LIVER AND BILIARY SYSTEM.

a. Investigation of the hepatobiliary disease.

b. Hepatomegaly

c. Hepatitis

d. Cirrhosis**.**

e. Splenomegaly

f. Space occupying lesions / tumors of the liver.

g. Gall stones and cholecystitis

h. Obstructive jaundice.

i. Tumors of the gallbladder and the bile duct.

7. DISEASES OF THE JOINTS AND BONES.

a. Investigations of bone and joints diseases.

b. Low back pain.

c. Neck pain.

d. Joint pains

e. Osteoarthritis and related disorders.

f. Rheumatoid arthritis and Juvenile idiopathic arthritis.

g. Osteoporosis.

h. Osteogenesisimperfecta.

i. Osteomalacia and rickets.

8 DISEASES OF THE NERVOUS SYSTEM.

a. Investigation of neurological disease.

b. Disturbances of the visual system.

c. Cerebrovascular disease.

d. Disorders of the spine and spinal cord.

e. Intracranial neoplasm.

f. Hydrocephalus.

g. Meningitis

h. Alzheimer

i. parkinsonism

9 INFECTIOUS DISEASE

Recommended Readings:

1:-Practice of Medicine by Davidson.

2:- Clinical Medicine by Parveen Kumar &Michael Clark

Practical Component: Basic Patient Care

The course enables the students to learn the basic practice skills required as a member of health care system.

Topics

- Obtaining & recording of the vital signs: temperature, pulse, respiration, blood pressure.
- Handling the patient, emergency care & handling of seriously ill or injured patients Basic life support (BLS).
- Patient transfer and body Mechanics
- Principles of hypodermic, subcutaneous, intramuscular, and intravenous injections
- Proper procedure for administration of enemas
- Artificial respiration and bedside radiography
- Handling patient with communicable disease
- The health care team; role of technologist in the health care team Emergencies in a Radiology department and how to handle them Catheterization purpose, equipment and method.
- Discussion of aseptic techniques; asepsis, antisepsis, sterilization, disinfection and handling of sterile articles.
- Terminology and Basic concepts asepsis
- Medical
- Surgical
- Sterile technique
- Pathogens
- Fomites, vehicle
- Vectors

- Nosocomial infections
- Cycle of infection
    - Pathogen
    - Source or reservoir of infection
    - Susceptible host
- Method of transmission

    i. Airborne / suspended, ii. Common vehicle, iii.Vector-borne.
- Standard precautions (Handling patients with communicable disease)

    i.Hand washing, ii.Gloves

Recommended Readings:

Patient Care in Radiography Mosbay

Patient Care for imaging technologists T.M Series notes

Final Professional B.Sc. Hons. Medical Imaging Technology

Paper I-NUCLEAR MEDICINE

Theory Hours: 150
Practical Hours: 200

The intention of this course of Nuclear Medicine is to provide necessary knowledge and to develop cognitive skills underlying the performance of the tasks typically required of entry level Imaging technologists in this specialized area. The course of Nuclear Medicine shall consist of two main parts theoretical teaching and Practical training which covers lab work and on patient supervised clinical hands on training. The core of this course is clinical skills to acquire Images by using patient required technology, Knowledge of safe practice, understanding of Image about normal and abnormal conditions, and professional attitude in accordance with the scope of profession.

Objectives:

Candidates must demonstrate competence in different nuclear medicine procedures.

Candidates should demonstrate the following skills when performing the procedures:

• Discus related physics contents

Evaluation of requisition;

• Patient instructions;

• Preparation and care;

• Selection, handling, and administration of radiopharmaceutical;

• Equipment configuration and patient positioning;

• Radiation safety; and

• Image processing and evaluation.

All procedures must be performed on patients, with the exception of thyroid therapy which may be simulated.

Contents:

Section-I

1. Introduction to Nuclear Physics

1. Atomic and nuclear structure
2. Artificial and natural radioactivity
3. Modes of radioactive decay
4. Exponential decay and; Half-life and mean life of radionuclides
5. Radioactive decay series and equilibrium

6. Interaction of high energy radiation with matter

2. Radiation Detection and Instrumentation

1. Basic principles of radiation detectors and their common properties
2. Gas-filled detectors and their application
3. Scintillation detectors
4. Rectilinear scanners
5. Non imaging probes
6. Scintillation counters
7. Dose calibrator
8. Scintillation camera
9. Multicrystal devices
10. Tomographic imaging technique, SPECT and PET;
11. Image production & display;
12. Image quality in nuclear medicine
13. Quality assurance procedures in Nuclear Medicine instrumentation
14. Use of computers in Nuclear Medicine-principles & applications to NM data acquisition, processing & display.

3. Radiation protection

1. Radiation quantities and units
2. Radioactive waste disposal
3. Radiation shielding and transportation of radioactive materials
4. Health physics instrumentation
5. Methods of safe Handling of Radionuclides and Pertaining Rules and Regulations

4. Radiochemistry and Radiopharmaceuticals

1. Radiopharmaceuticals
2. Production of radioisotopes
3. Radioisotope generators
4. Quality control and quality assurance of radiopharmaceuticals Hot laboratory and dispensing operations
5. Chemical toxicity of radionuclides.

5. Clinical nuclear medicine imaging

1. Systemic Nuclear Medicine teaching including application of radiopharmaceuticals for imaging of different organs
2. Indications of nuclear medicine diagnostic and therapeutic procedures
   Techniques of performing scintigraphy and common therapy procedures.
   Acquisition protocols, image processing and quantitation on images

Section-II

Following skills are required from the students during their practical training

- The techniques and methods of major nuclear medicine diagnostic and therapeutic applications
- Elution of Mo-Tc generator system
- Calculation of dose and preparation of radiopharmaceuticals.
- Quality control of radiopharmaceuticals

- Estimation of bound and free fraction.
- Thyroid uptake studies.
- Quality control tests for gamma camera.
- Routine operational tests for SPECT.
- Dynamic studies with patient. Static and SPECT studies

Section III Procedures:

Abscess and Infection
Skeletal
Cardiovascular
Endocrine/Exocrine
Gastrointestinal
Genitourinary
Respiratory
Central Nervous System
Tumor
SPECT
Therapeutic Procedures

Recommended Readings:

1. Ramesh Chandra. Nuclear Medicine Physics, Lippincott Williams And Wilkins, 2004.
2. Donald R Bernier, Nuclear medicine: technology and techniques. Mosby, 1997.
3. Manual of Nuclear Medicine Procedures by Raman Mistry.
4. Practical Nuclear Medicine by Peter F. Sharp, Howard G. Gemmel & Alison D. Murray.
5. Instructional Manual By TM Series.
6. Textbook of Radiology & Imaging by David Sutton, Rodney Reznek & Janet Murfitt.

Paper-II ANGIOGRAPHY & CARDIAC IMAGING

Theory Hours: 100
Practical Hours: 100

Description

Content is designed to present a systematic approach to the techniques and procedures technologists use in the performance of selective cardiac-interventional procedures. Common to the discussion of all procedures will be the following:

- Indications & Contraindications for the procedure.
- Patient positioning.
- Access method.
- Patient management during the exam.
- Contrast administration.
- Possible complications.
- Equipment.
- Exposure technique.

Objectives

1. Demonstrate knowledge of Cath Lab Equipment (X-Ray, Hemodynamic and other life saving and auxiliary equipment of Cath lab)
2. Demonstrate knowledge and skill to obtain vital signs
3. Recognizes normal and abnormal ECG.
4. Describe the Cine and digital image acquisition procedure.
5. Describe procedures performed in cath lab.
6. Identify Disposables i.e. Guide wires , Catheters and supplies
7. Identify the indications and contraindications for given cardiac-interventional procedures.
8. Recognize and respond effectively to patient complications that arise during the performance of cardiac-interventional procedures
9. Identify normal values of pressures, Lab and oximetry in Cath lab.
10. Demonstrate knowledge of Radiation Protection in Cath Lab.

The core of this course is clinical skills to acquire Images by using patient required technology, Knowledge of safe practice, understanding of Image about normal and abnormal conditions, and professional attitude in accordance with the scope of profession

Contents:

Review of following:

1. Vital Signs
2. Contrast and Cath Lab Medications
3. Asepsis and Sterile Technique
4. ECG & Lab Values
5. Radiation Protection

I. Imaging Equipment

A. Basic operation
B. Digital image acquisition

II. Diagnostic Cardiac Studies

A. Pulmonary angiography
B. Aortography
C. Coronary angiography
D. Internal mammary angiography
E. Saphenous vein graft angiography
F. Ventriculography

III. Percutaneous Coronary Intervention

A. Angioplasty
B. Debulking
1. Directional atherectomy
2. Rotational atherectomy
3. Laser atherectomy
C. Stent deployment
1. Drug eluting
2. Bare metal
3. Covered
D. Thrombolysis
1. Mechanical
2. Pharmacologic
E. Intravascular ultrasound

IV. Percutaneous Intervention (Other)

A. Congenital and structural heart diseases
1. Patent foramen ovale closure
2. Atrial septal defect closure
3. Patent ductusarteriosus closure
4. Coarctation of the aorta
B. Valvuloplasty
1. Aortic 2. Mitral
C. Septal Ablation

V. Therapy

A. Pericardiocentesis
B. Intraaortic balloon counterpulsation
C. Ventricular assist devices

VI. Hemodynamics and Circulations

A. Ventricular volume measurement
B. Shunt detection and calculation

C. Cardiac output calculation and measurement 1. Fick method 2. Thermodilution
D. Right and left heart hemodynamics

VII. Conduction System Studies

A. Arrhythmia detection
B. Arrhythmia ablation
C. Cardioversion
D. Implants 1. Pacemaker, permanent insertion
a. Single chamber
b. Dual chamber
c. 2. Internal cardiac defibrillator (ICD) insertion
a. Single chamber
b. Dual chamber
c. Biventricular
d. Recorder insertion
e. E. Pacemaker, temporary insertion
F. Electrophysiology studies

VIII. Pediatric Cardiology Interventions

A. Common anomalies
1. Atrial septal defect
2. Ventricular septal defect
3. Valvular stenosis
4. Tetralogy of fallot
B. Procedures for correction
C. Shunts
1. Calculations

IX. Guidewires and Catheters

A. Catheters 1. Characteristics
a. Dimensions
b. Shapes
c. Side/end holes
d. Recoil
e. Coatings (heparin, hydrophilic)
f. Tractability
g. Torque
h. Preparation
i. Construction
j. Function
k. Application
l. Complications
2. Types
a. Angiographic
b. Occlusion
c. Angioplasty (percutaneous transluminal angioplasty)
d. Atherectomy
e. Directional coronary Thrombectomy
g. Extraction (transluminal extraction catheter)
h. Intravascular ultrasound
i. Infusion

j. B. Guidewires
1. Resources
2. Physical characteristics
a. Dimensions
b. Shapes
c. Types
d. Coatings (heparin, hydrophilic)
3. Specialty guidewires
a. Diameter sizes
b. Lengths C. Guide catheters
1. Types
2. Preparation
3. Construction
4. Function
5. Application

X. Automatic Pressure Injectors

A. Parts
B. Function
C. Operation

XI. Medications

A. Types and Administration Routes
1. narcotics
2. antiarrhythmics
3. anticoagulants
4. antibiotics
5. thrombolytics
6. vasodilators
7. vasoconstrictors
8. emergency medications
9. antiemetics
10. platelet inhibitor
11. beta blocker
12. calcium channel blocker
13. sedatives
14. diuretics

B. Indications and Contraindications
C. Complications

XII. Patient Assessment and Monitoring (normal and abnormal values; implication for imaging)

A. Vital Signs
1. temperature
2. heart rate
3. respiration
4. blood pressure

B. Access Assessment
1. peripheral pulses

2. anatomical location

C. Lab Values

1. chemistry

a. glucose

b. BUN

c. creatinine

d. electrolytes

e. enzymes

2. hematology

a. hematocrit

b. hemoglobin

c. platelet count

d. white blood count (WBC)

3. coagulation

a. prothrombin time (PT)

b. partial thromboplastin time (PTT)

c. international normalization ratio (INR)

d. activated clotting time (ACT)

4. arterial blood gas a. pH b. PaCO2 c. HCO2

Clinical internship angiography

Recommended Readings:

1:- Manual of cath lab Personnel invasive cardiology by Sanoy Watson.

2:- Grossman's Cardiac Catheterization, Angiography, and Intervention 6thby Donald S. Baim, William, M.D. Grossman.

3:- Diagnostic & interventional catheterization in congenital heart disease by James E Lock.

4:- Cardiac Catheterization Handbook, by Morton J. Kern, Paul Sorajja MD& Michael J Lim.

5:- Rapid Interpretation of EKG by Dale Dubin.

Paper III MAGNETIC RESONANCE IMAGING

Theory Hours: 150
Practical Hours: 200

The course of Magnetic Resonance Imaging shall consist of two main parts theoretical teaching and Practical training which covers lab work and on patient supervised clinical hands on training. Student technologist will complete Log Book of all activities of clinical rotation under the supervision of an experienced MRI Tech and will show log book to external examiner in presence of his teacher (internal Examiner). The core of this course is clinical skills to acquire Images by using patient required technology, Knowledge of safe practice, understanding of Image about normal and abnormal conditions, and professional attitude in accordance with the scope of profession.

Objectives:

- Understands & explain fundamentals of MRI.
- Discuss equipment MRI Hardware & imaging system.
- Explain Image formation, Pulses &sequences and applications.
- Evaluate images for appropriate anatomy and overall image quality.
- Recognizes artifacts reasons and knowledge of prevention.
- Discuss equipment and supplies necessary to complete commonly performed MRI procedures.
- Explain common indications for MRI test.
- Explain the MRI acquisition protocol for commonly performed procedures.
- Explain indications for MRI contrast media application.
- Explain the patient safety and patient education about MRI Procedure.
- discuss the patient care
- Understand and analyze MRI request form and test requested.
- perform MRI Test of common regions as requested.
- Describe Procedure common protocols for each test

Contents

Section I: Physics & Instrumentation

- Basic Principles
- Imaging weighting and contrast
- Encoding and image Formation
- Parameters and trade-off
- Pulse sequences
- Flow phenomena
- Artifacts and their compensation
- Vascular and cardiac imaging
- Instrumentation and equipment
- MRI safety
- Contrast agents in MRI
- Advanced imaging techniques

- Nuclear Magnetic Resonance Spectrometry

Section II: Procedures

a. . Patient Care in MRI

- Patient Communication
- Patient Preparation
- Contrast Agents
- Injection Techniques

Section III MRI EXAMINATION BY ANATOMICAL REGION:

- Head and Neck.
- Angiography
- Spine
- Thorax including CVS
- Abdomen
- Pelvis
- Lower limb and Upper limb
- Joints
- Pediatric Imaging
- **CORONAL, SAGITAL AND AXIAL ANATOMY THROUGH MRI IMAGES.**
- **COMMON RADIOLOGICAL PATHOLOGIES.**

Recommended Readings:

1. Magnetic Resonance Imaging: Physical & Biological Principles by Stewart C. Bushong.
2. Hand book of MRI Technique by Catherine Westbrook
3. MRI in Practice by: Catherine Westbrook, Carolyn Kaut Roth, John Talbot
4. MRI At a Glance by Catherine Westbrook
5. Patient Care in Medical Imaging
6. Instructional Manual MRI TM Series
7. Radiologic Procedures by Chapman.
8. Textbook of Radiology & Imaging by David Sutton, Rodney Reznek & Janet Murfitt.
9. Clinical Radiology made ridiculously simple Atlas by Hugue Oulettue, Ara Kassarjian & Patrice Tetreault.
10. Anatomy for Diagnostic Imaging. Stephanie Ryan, Michelle McNicholas, Stephen J. Eustace.
11. Diagnostic Imaging: Andrea G. Rockall, Andrew Hatrick, Peter Armstrong, Martin Wastie

Paper IV-BIOSTATISTICS AND RESEARCH METHODS & PROJECT

Theory Hours: 50

Practical Hours: 300

Objectives:

- To enable the students to review the published research papers particularly from statistical stand points.
- To enable the students to initiate, undertake and participate in small scale study by collecting the data from real world situation and prepare the Research on its basis.

Contents:

1. **Introduction of Statistics**

   Background and definition of Statistics, descriptive and inferential statistics, Statistical data, source of data, collection of health related data, Management of data by tabulation, classification, graph, charts, Histogram, Pie chart, Scatter diagram and Line chart.

2. **Sampling and Sampling techniques**

   Concept of population and sample, reasons to use sampling, Random number and their application, sampling techniques; Random (simple random sampling, systematic, stratified random sampling, cluster sampling) and Non-random sampling (judgment sampling/purposive sampling, convenience, quota and snowball sampling), Determination of sample size, Error, Bias, sources of error and bias.

3. **Measures of Location and Dispersion**

   Measure of central tendency and its types, arithmetic mean, median, mode and Geometric mean, absolute and relative dispersion, Range, mean deviation, quartile deviation, standard deviation, variance, significance of standard deviation, coefficient of variation, Symmetry, skewness and its measure.

4. **Probability and Probability distribution**

   Introduction of probability and its uses in medical and health sciences, Venn diagram, concept of random experiment, definition of probability and its measurement, laws of probability, Bayes theorem and its application, Survival Analysis, Random variable, mathematical expectation, Binomial distribution , Poisson distribution, Normal distribution and its application, Normal curve and its properties.

5. **Statistical Inference**

   Introduction of inference, its types, Estimation and Testing of Hypothesis, Sampling distribution of mean, standard error of mean, Point estimation, confidence interval of population mean, null and alternative hypothesis, type I & II error, test of significance based on Z, t, F, χ^2 distributions, test of mean for small and large sample, test for

independent and paired observations, inference regarding correlation and regression coefficient, ANOVA (Analysis of variance)

6. **Regression and Correlation Analysis**

   Introduction to relationship, scatter diagram, regression analysis, simple linear regression line, least square method for fitting regression line, simple concept of multiple regression, correlation analysis, simple linear correlation and correlation coefficient , coefficient of determination, interpretation of correlation coefficient, Association , measure of association, contingency table, goodness of fit, Measurement of Risk in diagnostic process, odd ratio/hazard ratio.

7. **Review of Statistics**

   Descriptive and inferential statistics, Statistical data, source of data, collection of health related data, Management of data by tabulation,classification, graph, charts, Histogram, Pie chart, Scatter diagram and Line chart.

8. **Introduction to Research**

   Introduction to Research, Significance of research, Types of Research, Research process, Research Problem, selection of research problem, Review of Literature, Research Hypothesis, testing of research hypothesis

9. **Research Design**

   Basic concept of research design, Experimental and non-experimental design, Clinical trials, randomized controlled clinical trial, Validity and reliability of design.

10. **Measurement Scale**

    Meaning of measurement, measurement scale, different types of scale, nominal, ordinal, interval, and ratio scale

11. **Data collection Instruments**

    Methods of data collection, instruments of data collection, interview, observation, questionnaire

12. **Data Analysis & Report Writing**

    Preparation of data for analysis by using computer software SPSS, Minitab, Epi-info, MS-office, format and style of report, Referencing

Recommended Readings:

1. Dawson B, Robbert G: Basic & Clinical Biostatistics. McGraw-Hill International Edition, 2001
2. : Premier of Bio-Statistics. McGraw-Hill International edition, 2000
3. Ibrahim M. Biostatistics & Research Methods. IQRA RESEARCH CENTRE International Edition, 2007

Research Report

At the end of academic year each student must complete his research project under his/her supervisor.

Preparation and evaluation of technical comparative statement of specifications of

imaging modalities
Student shall select a modality from among the Medical Imaging modalities and prepare a comparative statement of the same modality manufactured by various manufacturers.

2. Comparison of two different modalities for any specific investigation

Student shall select a topic with consent to their teachers to compare the investigation of two different modalities for the same human body system.

Example:
Renal function test of nuclear medicine and IVP
Renal function test verses ultrasound
Angiocardiography verses nuclear medicine cardiac investigation

3. Student will prepare a comprehensive report on medical imaging investigation of any human body system

A student shall prepare a dissertation on any specific investigation which shall include details such as basic medical sciences, indication, contraindication detail of procedures and techniques, complication during investigation and management. Principles of Medical Imaging, detail of instruments and pharmacology. And a brief of other investigation available for the same body system. **A novel Project will be highly encouraged.**

RECOMMENDED BOOKS AND JOURNALS

- Ultrasound Teaching Manual: The Basics of Performing and Interpreting Ultrasound Scans by Mathias Hofer
- Diagnostic Ultrasound: Principles and Instructions by Frederick W. Kremkau
- Ultrasound By WHO
- Nuclear Medicine Physics: the basics by Ramesh Chandra
- Nuclear Medicine Technology and Techniques by Mosby, Donald R. Bernier, Paul E.Christian
- Periodical Publications and documents by: Board of Medical Imaging scientists Council of Allied Health Sciences Pakistan.
- Grossman's Cardiac Catheterization, Angiography, and Intervention (By Donald
- S. Rain., & William Grossman)
- Donald R Bernier, Nuclear medicine: technology and techniques. Mosby, @1997.
- Saha, G.B, " Fundamentals of Nuclear Pharmacy", Spring-Verlag,1992.
- Martin, A. and Harbison, SA, "An Introduction to Radiation Protection," (4th ed.), Chapman and Hill, 1996.
- Knoll G. F., "Radiation Detection & Measurements", 2nd Ed., John Wiley, 1990.
- Dawson B, Robbert G: Basic & Clinical Biostatistics. McGraw-Hill International Edition, 2001
- Neil J. Salkind: Exploring Research. Prentice-Hall, New-Jersey Park's: Text Book of preventive and social medicine.
- Stanton A: Premier of Bio-Statistics. McGraw-Hill International edition, 2000
- Ibrahim M. Biostatistics & Research Methods. IQRA RESEARCH CENTRE International Edition, 2007
- Kaplan, I. "Nuclear Phyisics", Narosa Pub, 1998.
- Gay. L.R. (1987) Educational Research: Competencies for Analysis and Applications Columbus: Merrill.
- Walpole, R.E.: Introduction to Statistic, Publishing Co. Inc, New York.
- Spiegel, Murray R.: Theory & Problems of Statistics, Sehawm Publishing Co., New York.
- Clarke's Positioning in Radiography by Clarke
- Radiographic Positioning by Eisenberg
- PARK'S; Text Book of Preventive and Social Medicine
- The Cardiac Catheterization Handbook by Mosby, Morton J. Kern

- Practice of Medicine by Davidson
- Practice of Medicine by Inaam Danish
- MRI Parameters and Positioning by Torsten B. Moeller
- MRI in Practice by Catherine Westbrook
- Handbook of MRI Techniques by Catherine Westbrook
- Radiologic Science for Technologists by Stewart C. Bushong
- The Essential Physics of Medical Imaging by Bushberg
- TM selection Notes
- Atlas of Mammographic Positioning by Lucinda K Prue
- Clarke's Positioning in Radiography by Clarke
- Short Practice of Surgery by Bailey and Love's
- Text Book of Surgery by Ijaz Ahsan.
- David Tucket (ed) 1976. An Introduction to Medical Sociology; London, Tavistock Publication.
- Moon graham, 1995, Society And Health; An Introduction to Social Science For Professionals, London; Rutledge

Rawalpindi Medical University

Log Book

BSc (Hons) Medical Imaging Technology

Log Book:

To keep track of student's clinical experience, Log book is mandatory. All Procedures and competencies are recommended by Board of Medical Imaging CAHSP to ensure minimum clinical competency of Graduate Imaging Technologists. Student shall present this log book to examiner for assessment of clinical experience.

Student's Personal Data

Name :	
RMU Registration Number:	
E Mail	
Mailing Address	
NIC#	

Authorization of Supervised Practical work & Log book maintenance

Program Director/Coordinator

Learning Objectives of Second Professional:

At the end of Second Professional a Student of Imaging technology will be able to:

1. Recognize Anatomy through X-ray images.
2. Understand body Planes and projections regarding radiography.
3. Recognize and understand role of different X-ray unites and supporting items.
4. Understands importance of different projections positions views of radiography.
5. Apply cardinal principles of radiation protection.
6. Understands role of pharmacology in Radiography.
7. Understand and apply patient care related to radiology.
8. Understand role of radiography in various medical conditions.
9. Perform Plain Radiography under supervision.

MIT student's record details of clinical experience at clinical

Mandatory competence of Second Professional MIT:

1. Requisition evaluation
2. Patient assessment
3. Room preparation
4. Patient management
5. Equipment operation
6. Technique selection
7. Patient positioning
8. Radiation safety
9. Imaging processing and image evaluation.

Mammography Clinical Competencies:

Specific Procedural Requirements

The candidate must meet initial requirements including, among other provisions, completion of 25 supervised mammography examinations. Documentation of completion is required.

Mammographic Examinations

The candidate must perform mammographic examinations (screening and/or diagnostic) on 50 patients addressing the following tasks in each examination. All examinations must be performed on patients (not phantoms or simulations).

Patient preparation/Education

•Provide for patient comfort and cooperation by familiarizing patient with the equipment and procedure, stressing the need for compression, and by providing general psychological support.

•Solicit and record patient clinical history relevant to the performance and interpretation of the mammographic examination.

•Document location of lumps, scars, moles, etc. by means of radiopaque markers on breast and/or diagram on clinical information sheet.

•Respond to patient questions on BSE, CBE, patient dosage, possible need for additional projections, ACS guidelines for screening mammography, and other breast imaging procedures.

Mammographic procedure

•Select equipment appropriate to the patient and the examination to be performed (e.g., image receptors, grids, compression plates, cassettes).

•Select exposure factors based upon breast tissue density, patient's age, numerical compression scale and equipment characteristics. •Select markers to document breast imaged and projection used.

•Position patient and equipment to provide projections specified by department protocol or requisition form.

•Evaluate the images to assure that they contain proper identification and are of diagnostic quality.

Fluoroscopy & Special Radiological Procedures Clinical Competency Form

I. Patient Care

A. Evaluate and interpret request, check chart order	YES	NO
B. Record pertinent history from patient & compare chart		
C. Prepare room prior to patient's arrival		
D. Identify patient correctly: verbally		
E. Recognize needs of patient		
F. Identify patient distress symptoms		
G. Identify correct procedure for patient distress		
H. Locate emergency cart		
I. Maintain, clean, stock area		
J. Select, prepare, and administer contrast media		
K. Introduce Radiologist to patient prior to examination		
L. Apply appropriate methods of radiation protection		
M. Monitor and assist patient at all times		
N. Provide proper post-contrast study instructions to patient		

II. Mechanical Operations

A. Properly warm-up the tube	YES	NO
B. Prepare patient identification for images		
C. Set appropriate technical factors on control panel		
D. Manipulate control panel setting from fluoro to overhead, and overhead to fluoro		
E. Reset fluoro timer when applicable		
F. Transmit images to PACS following exam		

III. Procedures: The student should be able to set-up and assist in the performance of the following exams*, including positioning for any overhead images:

A. Esophagus	YES	NO
B. UGI		
C. Small Bowel Series		
D. Barium Enema		
E. Myelogram		
F. Arthrogram		
G.Bronchography		

**exams not available during the student's rotation may be marked "N/A"*

Mandatory Competence Of Third Professional MIT:

Ultrasound /Echo

An examination on one patient may be used for documentation of several procedures. The candidate must demonstrate appropriate:

•evaluation of requisition and/or medical record
•preparation of examination room
•standard precautions
•identification of patient
•patient assessment and education concerning the procedure
•patient positioning
•protocol selection
•image optimization (e.g., transducer selection, focal zone, FOV)
•image archiving
•image quality (e.g., artifacts)
•demonstration of anatomic region and pathology
•documentation of procedure and patient data in appropriate record

Ultrasound Procedures to be performed

Abdomen Studies Liver Gallbladder/biliary tract/CBD Pancreas Spleen GI tract Kidneys Adrenals Bladder Lymph nodes Prostate Aorta IVC Vasculature Superficial Structures Studies Scrotum and testis Breasts Thyroid	Gynecology Studies Uterus Adnexa obstetrics Studies First trimester* Second or third trimester* Fetal biophysical profile* Sterile techniques pediatric Studies (head, spine, hips, pyloric stenosis) vascular Studies (venous extremity Doppler, carotid Doppler, post catheterization complication) Echocardiography in Adult & Paediatric Equipment care mandatory Prepare transducer for intracavitary use Clean and disinfect transducer

Computed Tomography (CT) Clinical Performance Evaluation

I. Patient Care	**Yes**	**No**
A. Evaluate and interpret request, check chart order		
B. Record pertinent history from patient & compare chart		
C. Prepare room prior to patient's arrival		
D. Identify patient correctly: verbally and wristband		
E. Recognize needs of patient		
F. Identify patient distress symptoms		
G. Identify correct procedure for patient distress		
H. Locate emergency cart		
I. Maintain, clean, stock area		
J. Select and prepare/observe preparation of contrast media		
K. Assist with intravenous injection		

II. Scanning

A. Operation - Supervised performance of the following:	**Yes**	**No**
1.select patient information from system		
2.set appropriate exam protocol		
3.manipulate gantry when necessary		
4.utilize correct patient immobilization devices		
5.utilize operator console to begin patient scan		
6.interpret indexing on table & perform table movement		
7.initiate and complete scan (under direct supervision)		
8.demonstrate radiation protection during scans (technologist & patient)		
9.access images for manipulation following scans		
10. transfer image from operator’s console to PACS		

B. Procedures

1. Position and immobilize the patient for these exams*:	**Yes**	**No**
a. Head		
b. Chest		
c. Abdomen		
d. Spine		

2. Perform the following examinations*:	**Yes**	**No**
a. Head		
b. Chest		
c. Abdomen		
d. Spine		

**exams not available during the student's rotation may be marked*

Mandatory competence of Final Professional MIT:

Magnetic Resonance Imaging (MRI) Performance Evaluation

I. Patient Care

	YES	NO
A. Evaluate and interpret request, check chart order		
B. Record pertinent history from patient & compare chart		
C. Prepare room prior to patient's arrival		
D. Identify patient correctly: verbally		
E. Recognize needs of patient		
F. Identify patient distress symptoms		
G. Identify correct procedure for patient distress		
H. Locate emergency cart		
I. Maintain, clean, stock area		
J. Select and prepare/observe preparation of contrast media		
K. Assist with intravenous injection		

II. Scanning

	YES	NO
A. Operation - Supervised performance of the following:		
1.select patient information from system		
2.set appropriate exam protocol		
3.utilize correct patient immobilization devices		
4.utilize operator console to begin patient scan		
5.initiate and complete scan (under direct supervision)		
6.provide proper patient instructions during the scan		

7.demonstrate magnet safety before, during, and after scans		
8.access images for manipulation following scans		
9.transfer image from operator's console to PACS		

B. Procedures

1.Position and immobilize the patient for these exams*:	YES	NO
a. Head		
b. Spine		
c. Extremity		

2. Perform the following examinations*:

a. Head	YES	NO
b. Spine		
c. Extremity		

**exams not available during the student's rotation may be marked "N/A"*

Clinical Rotation Form (Prof)

Sr #	Date	Patient. ID	EXAM	O/A/UA	Technologist/ Supervisor

O= Observed A= Assisted UA= Unassisted

Make at least 100 copies of this page for log book