



PANJAB UNIVERSITY, CHANDIGARH-160014 (INDIA)
(Estd. under the Panjab University Act VII of 1947-enacted by the Govt. of
India)

FACULTY OF MEDICAL SCIENCES

OUTLINES OF TESTS SYLLABI AND COURSES OF READING

FOR

BACHELOR OF SCIENCE MEDICAL TECHNOLOGY (X-RAY)
For the Examination, 2016, 2017

Now new nomenclature from examination 2018 is

BACHELOR OF SCIENCE (MEDICAL TECHNOLOGY- X-RAY)

INTRODUCTION:-

Objectives:

6. The Director Principal of the Govt. Medical College, Chandigarh on the recommendation of the Coordinator of the course will have the authority to condone deficiency as prescribed in University rules from time to time.

7.

19. The successful candidates shall be classified in to divisions as under:

Those who obtain 60% or more but less than 75% marks of the aggregate marks shall be placed in the first division.

Those who obtain 50% or more marks but below 60% marks of the aggregate marks shall be placed in the second division.

20. The candidate shall be provided with the details marks card of each year after 1st, 2nd & 3rd year. The detail marks card shall indicate the division in which the candidate has passed the examination. The date of entry and leaving the course shall be shown on the certificate of the degree awarded to such candidates.

21. INTERNAL ASSESSMENT :

The candidates will be given 50 marks as internal assessment on the basis of their performance during the semester.

That a candidate be eligible to appear in the examination provided he/she secured a minimum of 35% marks in internal assessment in theory and practical separately.

That the Regulations/Rules, number of seats etc. for Bachelor of Science (Medical Technology X-ray) to be started from the session 2007-2008 be approved with the following changes

22)

Under the Regulations for the award of B.Sc. (Medical Technology X-ray) to be started from the session 2007-2008 be approved with the following changes

Rules of Examination for B.Sc. Medical Technology (x-ray) Course.

1. The students will not be allowed to appear in the examination unless he/she attends 75% of the total theory and practical in each subject separately.
- 2.

11. PART-II

Please refer to page no. 6 of Annexure A.

- d) Rule No. 1 to 9 which applies to both Part I and II examination.
- e) The candidate will be required to pass in all the subjects of Part-II at least six months before he/she shall be allowed to appear for the final examination of Part-III.
- f) A candidate who fails in one or more subjects will be given two more chances at six monthly intervals to pass in those subjects. However, if he/she fails to pass in those subjects in these two extra attempts he or she will be required to repeat the whole examination of Part-II.
- g) Marks of the examination are given in Appendix II.

12. PART -III

Please refer to page No. 6 & 7.

- d) Rules No. 1 to 9 will apply to part I, II and III examinations.
- e) A candidate who fails in one or more subjects will be given two more chances at six monthly intervals to pass in those subjects. However, if he/she fails to pass in those subjects in these two extra attempts he or she will be required to repeat the whole examination of Part-III.
- f) Marks of the examination are given in Appendix III.

13. Director Principal of the College is empowered to condone the shortage of attendance of lecturers as prescribed in University Rules in each course of theory and practical.

11A. In case of students joining late owing to the late admission with the approval of the Vice-Chancellor, their lecturers are to be counted from the date of joining. Deficiency in studies should be made up by arranging special classes for them at the level of Head of the Department.

11B. That a candidate is eligible to appear in the examination provided he/she secures a minimum of 35% marks in the internal assessment in theory and practical separately.

Appendix II (B.Sc. Medical Technology X -ray Course)

Distribution of Marks

	First Year (each subject)	Second Year (each subject)	Third Year (each subject)
Theory	100 Marks	100 Marks	100 Marks
Practical & Viva Voce	100 Marks	100 Marks	100 Marks
Internal Assessment	50 Marks	50 Marks	50 Marks
Total	250 Marks 1000 Marks	250 Marks 1000 Marks	250 Marks 1000 Marks

PART-II

- 1) Anatomy and physiology and related pathology of human body Part II
- 2) Equipment for Radio diagnosis Part II
- 3) Physics for medical imaging
- 4) Basic radiographic techniques II and special procedures

PART-III

- 1) Special procedure in Radio diagnosis, Planning & QA in Radio diagnosis
- 2) Equipment for Radio diagnosis including newer developments
- 3) Modern Imaging Technology
- 4) Radiation physics and radiation protection

Hours of instruction of theory and clinical training per week

10 hrs of teaching per week	[Part II]
30 hrs of clinical training per week	[Part II]
10 hrs of teaching per week	[Part II]
30 hrs of clinical training per week	[Part II]
10 hrs of teaching per week	[Part III]
30 hrs of clinical training per week	[Part III]

Total hrs teaching (theory only) for 3 years

Subject

Anatomy and physiology and related pathology

Operation theatre Technique	4 weeks
Skull including PNS and facial	6 weeks
Ward radiography/including trauma	6 weeks
MCU, RGU, and Cystography etc	6 weeks
Dental radiography	2 weeks
Total	40 weeks
PART- III	
Mammography	6 weeks
Interventional procedures ; vascular and nonvascular including ERCP, PTC, PTBD, and PCN etc	6 weeks
CT	6 weeks
US/Color Doppler	6 weeks
MRI	6 weeks
DSA	2 weeks
Quality assurance and radiation protection	6 weeks

MODE OF EXAMINATION

Final examinations is conducted at the end of each year in the following subjects
For the Part I, Part II, Part III , during the month of August

PART - I

Theory papers

- 1) Anatomy , physiology and related pathology of 100 marks

PART - II

One external examiner is Professor of Anatomy , Physiology

2nd external examiner is tutor of medical technology (~~X~~Ray)

During all the annual examinations the candidate shall have to obtain 50 % marks separately in theory plus internal assessment as well as in practical and viva voice examinations

INTRODUCTION

In the modern concept of medical service , the importance of the support from Paramedical professional cannot be over emphasized. For this

The student are evaluated by a system of internal assessment and three annual examinations the final examination at the end of the third year is a comprehensive one.

TRAINING

Appendicular skeleton: bones involved shoulder girdle and upper limb, Pelvic girdle and lower limb.

Healing of bones : Cellular activity

Factors that delay healing

Diseases of bones and joints

The Respiratory system

Organs Position and structure and function

Nose and nasal cavities

Functions: respiratory, Olfactory, Pharynx

Larynx Functions: respiratory, vocal

Tracheal, Bronchi, lungs: lobes, lobules, pleura

Respiratory function: External and internal respiration common terms relating to diseases and conditions of the system

- xii) The constitution of developing solutions and properties of developing chemicals.
- xiii) The development time, factors in the use of a developer. Developers in processing systems.
- xiv) Film processing: fixing and role of a fixing solution. Constitution of the fixing solutions and properties of the constituent.
- xv) Fixers used in automatic processors and factors affecting the use of the fixer.
- xvi) Regeneration of fixing solution Silver recovery and its various methods.
- xvii) Rinsing, washing and drying objections of rinsing and washing methods employed.
- xviii) Methods of drying films.
- xix) Preparation of solutions and making stock solution.
- xx) Processing equipment Materials for processing equipment, processors for manual operation, hangers, control of chemical temperature by heating and thermostat, immersion heaters as well as cooling methods.
- xxi) Maintenance of automatic processors and common faults.
- xxii) Dark Room: Layout and planning, Dark room construction nature of floor, walls, ceiling and radiation protection.
- xxiii) Type of entry , door design, Dark room illumination.
- xxiv) Dark room equipment and its layout, Location of pass through boxes cassette hatches.
- xxv) Systems for daylight film handing :daylight systems using cassettes and without cassettes.
- xxvi) The radiographic image: Components in image quality density contrast and details.

- xxvii) Unsharpness in the radiographic image, various factors ~~leading~~ ^{contributing} towards unsharpness.
- xxviii) The presentation of the Radiograph, Identifications markers and orientation Documentary preparation.
- xxix) Viewing accessories: Viewing boxes, magnifiers, viewing conditions.
- xxx)

PAPER-III

PATIENT CARE IN RADIOGRAPHY AND C.P.R

No. of lectures and practical demonstration 30-

Restraints and immobilization methods
Accidents and incident reports

EVALUATING AND MEETING PHYSICAL NEEDS

Meeting personal needs
Serving as a physician standard
Current status
Physical signs
Vital signs

CONTRAST MEDIA AND SPECIAL IMAGING TECHNIQUES

Iodinated contrast media
Aqueous iodine compounds for intravascular injection
Reaction to contrast media
Contrast examination of the urinary examination
IVU
CYSTOGRAPHY
Retrograde pyelography
Contrast examination of the biliary system
Oral cholecystography
Intravenous cholangiography
IPTC
T-TUBE
Other common contrast examination
Myelography
Contrast arthrography
Bronchography
Angiography
Skin preparation
Special imaging techniques
Computedomography
Diagnostic medicine sonography
Nuclear medicine
Mammography
Thermography

BEDSIDE RADIOGRAPHY SPECIAL CONDITION AND ENVIRONMENTS

Mobile radiography
Orthopaedic traction
Orthopaedics bed frames
The ICU
Tracheostomies
Nasogastric tubes
Closed chest drainage
Swan ganz catheters
The neonatal nursery
The surgical suite

C.P.R.

Basics of CPR
How to give CPR

Precaution during CPR

PAPER-IV

BASIC RADIOGRAPHIC TECHNIQUE -1 RADIOGRAPHY TECHNIQUES

Skeletal system: Radiography techniques for Xof:

- a. Upper limb with special reference to hand wrist joint, and elbow joint, Supplementary techniques for carpal tunnel, scaphoid bone fracture, head of radius and condylar projections.
- b. Lower limb which includes all the bones with special reference to ankle joints, knee joint, patella, techniques for calcaneum bone, supplementary techniques for flat foot, intercondylar notch and femur and metatarsals, etc.
- c. Shoulder girdle and thorax,
- d. Vertebral column with special techniques for cervical spine, intervertebral joint and foramina, Lumbosacral joint.
- e. Pelvic girdle and hip region.
- f. Respiratory system Chest radiography for both the lungs, apical, lordotic and oblique views, lateral views techniques to demonstrate fluid levels, effusion in the thorax

OUTLINES OF SYLLABUS FOR SECOND YEAR.

PAPER-I

No. of Lectures & Practical Demonstration : 40

1. Anatomy and Physiology and related pathology of human body.

Review of

Types of Cells , tissues , bones and joints . Introduction to system and cavities of the body.

a) Heart and blood vessels(Circulatory System)

Blood vessels arteries, veins, capillaries, sinusoids, structure and functions.

Heart Position , structure and functions.

Circulation of blood Pulmonary , systemic , portal, main blood vessels, their origins and distribution (Arteries, Veins, Capillaries) and their functions of the system

Mouth Position ,structure and functions
Pharynx- Position ,structure and functions
Salivary glands Position ,structure and functions.
Esophagus Position ,structure and functions
Stomach-- Position ,structure and functions.
Liver -- Position ,structure and functions.
Gallbladder-- Position ,structure and functions
Small intestine Position ,structure and functions.
Large intestine- Position ,structure and functions

Digestion and absorption, Metabolism of carbohydrates. Proteins and fats . Diseases and conditions of the digestive systems.

d) The Urinary System

Parts of urinary systems.
Kidneys- Position ,structure and functions
Ureters- Position ,structure and functions
Urinary bladder-- Position ,structure and functions
Urethra-- Position ,structure and functions.

Formation and composition of urine.
Water and composition of urine.
Water and electrolyte balance.
Diseases and conditions of the system.

e) The reproductive system

Female reproductive system

External genitalia : position ,structures and functions.

Perineum.

Internal organs : Position ,structure and functions
Vagina
Uterus
Fallopian tubes
Ovaries

Menstrual cycle : stages , hormone control , ovulation

Breasts (mammary glands) Position ,structure and functions.

Changes : puberty , in pregnancy , during lactation.

Male reproductive system.

Scrotum ,testis ,epididymus : Position ,structure and functions.

Spermatogenesis .

Spermatic cords, seminal vesicle, ejaculatory ducts : Position ,structure and functions.

Prostate glands Position ,structure and functions

Urethra and penis- Position ,structure and functions

Functions of male reproductive system.

Puberty

Disease of female and male reproductive systems

Endocrine system

Endocrine glands :

Pituitary and hypothalamus : Position ,structure and functions

Thyroid glands : Position ,structure and functions

Adrenal (Supra renal gland) Position ,structure and functions

Parathyroid glands ; Position ,structure and functions

Pancreas : Position ,structure and functions

Hormones : secretion , function & control.

Pineal gland.

Common terms and disease related to the Endocrine system.

The organs of sense :

Hearing and the ear : external, middle and inner ear. Position ,structure and functions

Physiology of hearing and diseases of ear.

Sight and the eye : Position ,structure and functions

Sclera , cornea ,choroids , ciliary body , iris ,lens ,retina ,optic nerves.

Physiology of sight and disease of the eye

Sense of the smell : olfactory nerves origins ,distribution.

Physiology of the smell.

Sense of taste. organs , physiology of the taste.

Common disease of the system.

The nervous systems.

Neurons :Position ,structure and functions

Central nervous system : neurons, neuralgia , meninges.
Ventricles of the brain, C.S.F.

The self rectified high tension circuit.
The half wave. rectified circuit.
The four valve full wave rectified circuit
Three phase full wave rectified circuit.
Voltage waveforms in high tension generators.
Constant potential circuits
Rectifiers valves and solid state.
The high frequency generators advances and newer development.

b) The X-ray Tube:

General features of the x-ray tube.
The fixed anode

f) Fluoroscopic equipment

- 1 . RADIATION PHYSICS :-Structure of atom, electromagnetic radiation, production of xrays, interaction of x-ray, absorbed dose, filtration
- 2 . IMAGING WITH X -RAYS:-Attenuation of xrays by the patient, effect of scattered radiation, secondary radiation grid, magnification and distortion,unsharpness and blurring,tomography.limitation of x rays tube
- 3 . RADIOGRAPHY WITH FILMS AND GRIDS :- Intensifying Screens ,films, characteristic curve, radiographic contrast, screen blurring, quantum mottle or noise, choice of exposure factor, macroradiography, mammography, xeroradiography
- 4 . FLUOROGRAPHY,DIGITAL IMAGING AND COMPUTED TOMOGRAPHY: - Fluoroscopy, digital imaging, computed tomography ,PACS
5. GAMMA IMAGING :- Radioactivity, radioactive transformation , gamma imaging, radiopharmaceuticals, dose to the patient, precaution to be taken in the handling of radionuclides, tomography with radionuclides
- 6 . IMAGING WITH ULTRA SONUD:- Piezoelectric effect, interference, single transducer probe, behavior of a beam at an interface between different materials, attenuation of ultrasound,-mode, Bmode, Real time imaging, gray scale imaging, resolution, artifacts,-mode, Doppler methods, safety

3 DENTAL RADIOGRAPHY :- Radiography of teeth intra oral, extra oral and occlusal view.

4. ALIMENTARY TRACT :- Preparation of patient. General, acute positioning for fluid and air levels, Plain film examination , Radiography of female abdomen to look for pregnancy : intravenous Pyelography and cystography.
5. MACRORADIOGRAPHY :- Principal, advantage, technique and applications .
6. STEREOGRAPHY :- Procedure , presentation for viewing, stereoscopes, stereometry
7. SOFT TISSUE TECHNIQUE :- Mammography , localization of foreign bodies,
8. WARD MOBILE RADIOGRAPHY :- electrical supply, radiation protection equipment and instructions to be followed for portable radiography
9. OPERATION THEATRE TECHNIQUES :- General precautions ,

Intraventricular radiological procedures:

PTC PTBD, ERCP, fine needle aspiration cytology, percutaneous nephrostomy.

Cardiac catheterization embolization, dilation etc.

PART - III

PAPER I

SPECIAL PROCEDURES IN RADIODIAGNOSIS, PLANNING AND QA IN RADIODIAGNOSIS

NO. of Lectures & Practical Demonstration : 40

Radiological procedures pertaining to salivary glands , lachrymal system
Bronchography , arthrography and hysterosalpingiography various requirements trolley set up, indications and contra indications, contrast media used .

Ventriculography and encephalography :- Technique, contrast media used, film sequence . indications and contra indications ,

Myelography :- Technique, contrast media used , injection of contrast media indications and contra indications .

Intravenous cholangiography , T Tube ÷ Cholangiography, preoperative cholangiography , procedure , contrast media , indication and contraindications .

Double contrast Barium studies:- (small bowel enema , Ba Enema etc)
Procedure , requirements, indications, contra indications and contrast media use

Angiography :- Cerebral, cardiac , abdominal aortography , general , renal and selective renal. Splenoportovenography , peripheral, arterial and venous angiography, precautions, precautions , radiation protection , film changers , manual automatic biplane, film types large, miniature, cine contrast media injection procedure and technique.

Interventional radiological procedures :- PTC, PTBD, ERCP , fine needle aspiration cytology , percutaneous nephrostomy

Quality Assurance in Radiodiagnosis:- Aim of quality assurance in ,medical imaging , Q.A. Programme i.e. phases of development of its radiological facility
Q.A. , activities applicable in.

- i) Equipment selection phase
- ii) Equipment installation of acceptance phase
- iii) Operational phase .

PLANNING IN RADIO -DIAGNOSIS :-

Location of the department
Adjacent department and areas
Basics of the imaging rooms
Patient waiting areas

Basics infrastructures of the imaging rooms .
Etc

PAPER-II

2. Equipment for Radio diagnosis including newer development

NO. of lectures & Practical Demonstration :20

1. Computed tomography:- Historical developments , its principle and applications , various generations and definition of terms and cross sectional anatomy
2. Diagnostic Ultrasound:- Its principle, applications and role in medicine. Various types of transducers and definition of terms and cross sectional anatomy
3. Digital Radiography :- Principle , scanned projection radiography , digital subtractions angiography , applications and definition of terms .
4. MRI :- Principle , applications , its -:611.9773 0 0 7.53512(i)37.5446(o)v17.8218(n)19.56

1. ULTRA SONOGRAPHY

Ultra sonography
Doppler ultrasound
Doppler flow imaging , principle of ultrasound
Types of transducers
Basics of Doppler ultrasound system

2. CT SCAN

Conventional CT
Spiral CT
Basic principle
CT Technique
Equipment description
CT artifacts
Indications
Contraindications
Contrast media used

3 MRI

Basic Principle
Equipment description
MR Angiography
MR artifacts
Indications
Contraindications
Contrast media used

4. NUCLEAR MEDICINE

Definition
Contrast media / imaging material used
Characteristics of radionuclide
Commonly used radio nuclides
Descriptions of equipments
Imaging technology
Uses and advantages

5. PET- SCAN

Definitions
Basic principle of PET-SCAN
Equipment description
Imaging materials used

Imaging technology
Advantages PETSCAN

6. MAMMOGRAPHY

Basic principle of mammography
Equipment description
Imaging technology
Importance
Uses and advantages

7. PORTAL IMAGING

Basic principle of portal imaging
Devices
Imaging technology
Advantages and uses
Importance of portal imaging

8. INTERVENTIONAL RADIOLOGY

Atomic structure as applied to generation of X-rays and radioactivity of diagnostic imaging and therapy X-rays. Effects of variation of tube voltage, current, filtration, HT waveform and target material on X-ray production. Law of radioactivity and decay schemes of different alpha, beta and gamma ray, negatron and positron emitters as used in medicine, especially in radiotherapy. Artificial radioisotope generators employed in medicine in general and radiotherapy sources in particular. Interaction of radiation with matter attenuation absorption and scattering phenomenon. Photoelectric absorption, Compton scattering, pair production and annihilation process, ionization, effects of geometry of thickness of the absorber. Dependence on the nature and Atomic number of the absorber and on radiation quality. transmission of X-ray through body tissue. Linear energy transfer. Range of secondary electrons and electron build up. Relative amounts of scatter from homogeneous and heterogeneous beam during the passage through a patient. Physical requirements of beam during the passage through a patient. Physical requirements of beam defining devices e.g. cones diaphragm, collimator etc. Units of radiation measurement specification of quality and half value thickness (HVT) and its measurement filters and filtration. Measurement of radiation and dosimeter procedures. radiation detectors and their principles of working. Definition of Bragg peak, percentage depth dose, peak scatter factor, tissue air ratio. tissue, tissue maximum ratio scatter air ratio, is dose curves and radiation penumbra of different beams. Wedge filters, wedge angle, hinge angle. Compensators, beam flattening filters, scattering foils. Physical properties of phantoms, phantom materials, bolus and bolus substitutes. Factors used for treatment dose calculations, daily treatment time and monitor units calculation method. Physical aspects of electron and neutron beam therapy.

RADIATION PROTECTION : -

Definition of radiation hazards maximum permissible dose and annual limit of intake (ALI), permissible dose levels on and around sealed source housing and installation principles of radiation protection and ALARA. Physical principle of design and planning of radiation installation. Safe work practice in teletherapy and brachytherapy. Shielding materials. Radiation survey and personnel monitoring devices film badges, TLD badges. pocket dosimeters in Head and neck cancer

