

Regn. No.....

Paper Code: BRIT-201...

B.Sc. MEDICAL TECHNOLOGY (RADIOGRAPHY AND IMAGING)
SECOND YEAR EXAMINATION, JULY - 2018
RADIOGRAPHIC PHOTOGRAPHY
PAPER - I

[Time allotted: Three hours]

[Max Marks: 70]

Note: Attempt all questions

Draw suitable diagram wherever necessary

A : Short answer questions:

(7 x 9 = 63)

- Q. 1.** What are different layers contained in a radiography film? Write the function of each.
- Q. 2.** Describe the process latent image formation on X-ray films.
- Q. 3.** Mention various safety aspects related to storage of radiographic films in darkroom.
- Q. 4.** Define photographic density. What is its relation with exposure?
- Q. 5.** Why are intensifying screens used in x- ray imaging? Highlight its different layers and their roles in it.
- Q. 6.** What is replenishment in film processing? Why it is needed?
- Q. 7.** Define luminescence. Describe the device based on luminescence used in a radiology department.
- Q. 8.** What is the source of quantum mottle in radiographic images? On what factors does it depend?
- Q. 9.** What is geometric unsharpness? Describe its various sources.

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B.Sc. MEDICAL TECHNOLOGY (RADIOGRAPHY AND IMAGING)
SECOND YEAR EXAMINATION, JULY - 2018
RADIOGRAPHIC PHOTOGRAPHY
PAPER - I (MCQ)

Time allotted for MCQ-15 minutes

(½ x 14= 7)

B : MCQs (Single response type):

Select the most appropriate answer and **encircle** the alphabet against it

1. Lead equivalence of the walls of an x-ray room should be at least:
 - a. 0.5 mm
 - b. 1.5 mm
 - c. 2.5 mm
 - d. 3.0 mm
2. The color of safe light used in x-ray dark rooms is:
 - a. Red
 - b. Green
 - c. Blue
 - d. Any color
3. By increasing Kv, contrast of the image:
 - a. Increases
 - b. Decreases
 - c. Remain unchanged
 - d. Fluctuates randomly
4. Development of unexposed silver on a radiography film results in:
 - a. Image noise
 - b. Image unsharpness
 - c. Film fog
 - d. None of these
5. Film contrast and latitude are:
 - a. Directly related
 - b. Inversely related
 - c. Exponentially related
 - d. None of these
6. Statistical fluctuation of X-ray photons in the beam produces :
 - a. Quantum mottle
 - b. Heel effect
 - c. Increase in patient dose
 - d. None of these
7. A film characteristic curve does not give information about:
 - a. Contrast
 - b. Speed
 - c. Latitude
 - d. Kv
8. The process of film development is:
 - a. Oxidation
 - b. Reduction
 - c. Ionization
 - d. Dehydration
9. Mammography film is a:
 - a. Single screen
 - b. Double screen
 - c. Without screen
 - d. All types
10. "Hypo" is a:
 - a. Developing agent
 - b. Fixing agent
 - c. Replenisher
 - d. Preservative
11. This is an antifogging agent used in manual processing:
 - a. Hydroquinone
 - b. Sodium carbonate
 - c. Sodium sulfite
 - d. Potassium bromide
12. Lanthanum oxybromide is a:
 - a. TLD material
 - b. Film emulsion
 - c. Rare earth phosphor
 - d. None of these
13. Radiographic films are double coated to increase:
 - a. Contrast
 - b. Sharpness
 - c. Resolution
 - d. Latitude
14. Characteristic curve of radiography film is:
 - a. U-shaped
 - b. V-shaped
 - c. S-shaped
 - d. C-shaped

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Paper Code: BRIT-202...

B.Sc. MEDICAL TECHNOLOGY (RADIOGRAPHY & IMAGING)
SECOND YEAR EXAMINATION, JULY - 2018
MEDICAL PHYSICS & EQUIPMENTS
PAPER - II

[Time allotted : Three hours]

[Max Marks : 70]

Note: Attempt all questions.

Draw suitable diagrams wherever necessary.

A : Short answer questions:

(7 x 9 = 63)

- Q. 1. Write about planning consideration for installation of a 500 mA X-ray machine.
- Q. 2. Describe photoelectric effect and its application in diagnostic radiology.
- Q. 3. Explain parameters affecting scatter radiation and methods to reduce it.
- Q. 4. Draw a labelled diagram showing modern diagnostic X-ray tube and electric circuit of X-ray generators.
- Q. 5. What is digital radiography? Discuss its advantages and disadvantages.
- Q. 6. List the factors contributing reduced radiation dose to patient and operator.
- Q. 7. Define basic units of radiation exposure. List recommended dose limits for a radiation worker and for general public.
- Q. 8. Describe the structure and types of intensifying screens. List advantages and disadvantages of their use.
- Q. 9. Explain factors affecting quality of radiographs.

B.Sc. MEDICAL TECHNOLOGY (RADIOGRAPHY & IMAGING)
SECOND YEAR EXAMINATION, JULY - 2018
MEDICAL PHYSICS & EQUIPMENTS
PAPER - II (MCQ)

Time allotted for MCQ-15 minutes

(½ x 14 = 7)

B : MCQs (Single response type):Select the most appropriate answer and **encircle** the alphabet against it

1. Who discovered X-rays?
 - a. Wilhelm Conrad Roentgen
 - b. Normann
 - c. William Harvey
 - d. J J Thomson
2. Quantity of X-rays produced does **not** depend on:
 - a. Atomic number of target material
 - b. Atomic mass of the target material
 - c. Square of kVp
 - d. Milli amperes of X-ray tube
3. A device that allows electric current to flow only in one direction is known as:
 - a. Filter
 - b. Grid
 - c. Rectifier
 - d. Intensifying screen
4. Which is **true** about photoelectric effect?
 - a. Photoelectric effect is directly proportional to square root of atomic number
 - b. Photoelectric effect is directly proportional to square of atomic number
 - c. Photoelectric effect is directly proportional to cube of atomic number
 - d. Photoelectric effect is inversely proportional to atomic number
5. Attenuation does **not** depend on:
 - a. Atomic number
 - b. Density
 - c. Electrons / gram
 - d. kVp
6. What is the most important ingredient of photographic emulsion?
 - a. Gelatin and silver halide
 - b. Only silver halide
 - c. None of the above
 - d. Only gelatin
7. Dose equivalent is measured in:
 - a. Coulombs
 - b. Grays
 - c. Seiverts (Sv)
 - d. Man-seiverts
8. The effective dose from a PA chest examination is typically:
 - a. 2 msv
 - b. 20 msv
 - c. 0.02 msv
 - d. 0.2 msv
9. Ways to improve contrast in tissue are all **except**:
 - a. Reduce kV
 - b. Increase mA
 - c. Use grids
 - d. Contrast media
10. Regarding TLD, which is true?
 - a. Uses lithium fluoride as active ingredient
 - b. Used for whole body dosage
 - c. Cannot be reduced
 - d. Permanent records achieved
11. Protective devices in radiography rooms are made of:
 - a. Silver
 - b. Tungsten
 - c. Lead
 - d. Molybdenum
12. Regarding tungsten as target, all are true **except**:
 - a. High melting point
 - b. High vapour pressure
 - c. High thermal conductivity
 - d. High atomic number
13. Increasing the kilovoltage setting for an exposure will:
 - a. Reduce the skin dose and improve contrast
 - b. Increase skin dose and improve contrast
 - c. Reduce skin dose
 - d. Increase sharpness
14. Factors affecting scatter radiation are:
 - a. kVp
 - b. Part thickness
 - c. Field size
 - d. All of the above

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B.Sc. MEDICAL TECHNOLOGY (RADIOGRAPHY & IMAGING)
SECOND YEAR EXAMINATION, JULY - 2018
RADIOGRAPHY (I)
PAPER - III

[Time allotted : Three hours]

[Max Marks : 70]

Note: Attempt all questions

Draw suitable diagrams wherever necessary

A : Short answer questions:

(7 x 9 = 63)

- Q. 1. Write the radiography method for lower extremity including pelvis.
- Q. 2. Discuss any five practical methods of reducing radiation dose to patient.
- Q. 3. Describe the checklist for an X-ray unit to perform speedy investigation.
- Q. 4. Briefly write the methods for X-ray sacrum and coccyx.
- Q. 5. What are different considerations to carry out radiological investigation of an MLC patient?
- Q. 6. Describe the radiological anatomy of pelvis and technique of radiography of pelvic girdle.
- Q. 7. Discuss radiography techniques of vertebral columns and abdomen.
- Q. 8. Describe the advantages and disadvantages of macro-radiography.
- Q. 9. Write short notes on:
 - a. CT abdomen
 - b. 10 days rule

(3.5 x 2)

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B.Sc. MEDICAL TECHNOLOGY (RADIOGRAPHY & IMAGING)
SECOND YEAR EXAMINATION, JULY - 2018
RADIOGRAPHY (I)
PAPER - III (MCQ)

Time allotted for MCQ-15 minutes

B : MCQs (Single response type):

(½ x 14 = 7)

Select the most appropriate answer and encircle the alphabet against it

1. Subtalar joint is between the:
 - a. Tibia and fibula
 - b. Talus and fibula
 - c. Talus and calcaneus
 - d. Talus and tibia
2. The largest of the tarsal bone is termed as:
 - a. Talus
 - b. Calcaneus
 - c. Cuboid
 - d. Navicular
3. MP joints and CM joints are used to describe the:
 - a. Hand
 - b. Face
 - c. Head
 - d. Hip
4. The line from the lowest point on inferior orbital margin to upper border of external auditory meatus is called:
 - a. Auricular line
 - b. Inter-orbital line
 - c. OMB line
 - d. Anthropological base line
5. X-ray projection knee intercondylar fossa is taken in:
 - a. PA
 - b. AP
 - c. Tunnel
 - d. Oblique
6. Bones on each hand and wrist are:
 - a. 26
 - b. 27
 - c. 28
 - d. 25
7. Sunrise view is used to see the:
 - a. Femoral condyles
 - b. Patella
 - c. Tibial condyle
 - d. Fibular head
8. Which projection shows the coronoid process free of superimposition?
 - a. AP elbow
 - b. Lateral oblique elbow
 - c. Medial oblique
 - d. AP forearm
9. The spine of the scapula is on which side?
 - a. Lateral
 - b. Medial
 - c. Posterior
 - d. Inferior
10. Rotation of the forearm showing the palm facing down is called:
 - a. Hyperflexion
 - b. Inversion
 - c. Supination
 - d. Pronation
11. The wrist bones are known as:
 - a. Carpals
 - b. Metacarpals
 - c. Tarsals
 - d. Phalanges
12. In portable radiography, minimum distance between X-ray source and radiographer should be:
 - a. 1 meter
 - b. 2 meter
 - c. 3 meter
 - d. 4 meter
13. BMD stands for:
 - a. Body mass development
 - b. Bone meter dimension
 - c. Bone mineral density
 - d. None of the above
14. Non-grid techniques are used for:
 - a. Adult patients
 - b. Pediatric patients
 - c. Geriatric patients
 - d. Female patients

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**B.Sc. MEDICAL TECHNOLOGY (RADIOGRAPHY AND IMAGING)
SECOND YEAR EXAMINATION, AUGUST - 2019
RADIOGRAPHIC PHOTOGRAPHY
PAPER - I**

[Time allotted: Three hours]

[Max Marks: 70]

Note: Attempt all questions

Draw suitable diagram wherever necessary

A : Short answer questions:

(7 x 9 = 63)

- Q. 1.** What is intensification factor? What does it indicate?
- Q. 2.** Write various safety constraints used in the layout and planning of a radiology darkroom.
- Q. 3.** Briefly discuss about the different ingredients of an automatic developer.
- Q. 4.** Define luminescence. Mention the use of luminescence in a radiology department.
- Q. 5.** Define optical density produced on a radiography film. What is its relation with radiation exposure?
- Q. 6.** Define the characteristic curve of a radiography film. What information does it give?
- Q. 7.** Describe general types of film faults and their causes.
- Q. 8.** Describe the influence of kV and scattered radiation on image quality.
- Q. 9.** Discuss the process of latent image formation.

B.Sc. MEDICAL TECHNOLOGY (RADIOGRAPHY AND IMAGING)
SECOND YEAR EXAMINATION, AUGUST - 2019
RADIOGRAPHIC PHOTOGRAPHY
PAPER - I (MCQ)

Time allotted for MCQ - 15 minutes

B : MCQs (Single response type):

(½ x 14 = 7)

Select the most appropriate answer and encircle the alphabet against it.

1. Lead equivalence of the walls of an x-ray room should be at least:
 - a. 0.5 mm
 - b. 1.5 mm
 - c. 2.5 mm
 - d. 3.0 mm
2. The color of safe light used in x-ray dark rooms is:
 - a. Red
 - b. Green
 - c. Blue
 - d. Any color
3. The radiosensitive material in an x-ray film is:
 - a. Gelatin
 - b. Adhesive layer
 - c. Silver halide
 - d. Base
4. Mammography film is a:
 - a. Single screen
 - b. Double screen
 - c. Without screen
 - d. All types
5. The back side of an x-ray cassette is made of:
 - a. Aluminum
 - b. Tungsten
 - c. Lead
 - d. Molybdenum
6. The role of intensifying screens is to:
 - a. Reduce patient dose
 - b. Improve image quality
 - c. To hold the film
 - d. All of the above
7. Phosphor of IF screens contain:
 - a. Tissue equivalent material
 - b. Silver halide
 - c. Hydrogen peroxide
 - d. Tungsten
8. Rare earth phosphor IF screens are used to increase:
 - a. Contrast
 - b. Sharpness
 - c. Latitude
 - d. Speed
9. An antifogging agent used in manual processing:
 - a. Hydroquinone
 - b. Sodium carbonate
 - c. Sodium sulfite
 - d. Potassium bromide
10. With manual development, radiographic exposure is based on time and temperature as:
 - a. 5 min, 40°C
 - b. 10 min, 40°C
 - c. 5 min, 20°C
 - d. 10 min, 20°C
11. X-ray film boxes should be stored in the darkroom in the position:
 - a. Flat one upon another
 - b. Upright
 - c. Hanging
 - d. Tilted
12. What is produced on the image due to scattered radiation?
 - a. Un-sharpness
 - b. Fog
 - c. Poor latitude
 - d. All of these
13. "Hypo" is a:
 - a. Developing agent
 - b. Fixing agent
 - c. Preservative
 - d. Restrainer
14. Pass box of the dark room should have lead equivalent of:
 - a. 1 mm Pb
 - b. 0.5 mm Pb
 - c. 0.25 mm Pb
 - d. 2.5 mm Pb

B.Sc. MEDICAL TECHNOLOGY (RADIOGRAPHY & IMAGING)
SECOND YEAR EXAMINATION, AUGUST 2019
MEDICAL PHYSICS & EQUIPMENTS
PAPER - II

[Time allotted: Three hours]

[Max Marks: 70]

Note: Attempt all questions.

Draw suitable diagrams wherever necessary.

A : Short answer questions:

(7 x 9 = 63)

- Q. 1. What are various aims of quality assurance of a radiological facility? Briefly discuss about any two tests that you perform during operational phase of radiography unit.
- Q. 2. Briefly describe the basic principle of tomography.
- Q. 3. Describe the composition and structure of radiography grids. What grid ratio indicates?
- Q. 4. Briefly discuss ICRP principles of radiation protection. Define LET and MPD.
- Q. 5. Briefly discuss the health effect of ionizing radiation.
- Q. 6. Write short notes on:
a. Common x-ray tube faults
b. High tension transformer
- Q. 7. Define the following:
a. Bremsstrahlung radiation
b. Potter bucky grid
- Q. 8. Define image quality. Write various aspects of radiographic image quality.
- Q. 9. Define the principle of line focus in x-ray tubes. What is its utility?

B.Sc. MEDICAL TECHNOLOGY (RADIOGRAPHY & IMAGING)
SECOND YEAR EXAMINATION, AUGUST - 2019
MEDICAL PHYSICS & EQUIPMENTS
PAPER - II (MCQ)

Time allotted for MCQ - 15 minutes

(½ x 14 = 7)

B : MCQs (Single response type):

Select the most appropriate answer and **encircle** the alphabet against it.

1. Target material of an x-ray tube is made of:
 - a. Low Z high melting point material
 - b. Medium Z low melting point material
 - c. High Z high melting point material
 - d. Low Z low melting point material
2. Mas is related to:
 - a. Penetration power of the beam
 - b. Radiation exposure
 - c. Scatter radiation
 - d. None of the above
3. What is responsible of 'Heel effect' in x- ray images?
 - a. Focusing cups
 - b. Anode angle
 - c. Small focal spot
 - d. Added filters
4. Target material mostly used in mammography tubes is:
 - a. Molybdenum
 - b. Beryllium
 - c. Pyrex
 - d. Silicon
5. Rotating anode in x-ray tube is used to:
 - a. Reduce scatter radiation
 - b. Increase target heat loading capacities
 - c. Increase x- ray intensity
 - d. All of the above
6. Grids:
 - a. Reduce scatter
 - b. Increase patient dose
 - c. Contain lead
 - d. All of the above
7. Optimum lead equivalency of a lead apron is:
 - a. 0.5 cm
 - b. 1 cm
 - c. 0.5 mm
 - d. 1 mm
8. Image intensifier contains:
 - a. Bigger input and smaller output phosphors
 - b. Smaller input and bigger output phosphors
 - c. Both same in size
 - d. It depends on image intensifier
9. In mobile radiography an infirm patient is supported (if required) by:
 - a. Radiographer
 - b. Patient's attendant
 - c. Radiography student
 - d. No one
10. A dental film is a:
 - a. Non screen double emulsion
 - b. Single screen double emulsion
 - c. Single screen single emulsion
 - d. Double screen double emulsion
11. During portable x-rays the distance of the radiographer from the patient should be at least:
 - a. 2 feet
 - b. 3 feet
 - c. 1 meter
 - d. 2 meters
12. A quality controlled radiography unit produces:
 - a. Good image quality
 - b. Reduced patient dose
 - c. Staff convenience
 - d. All of the above
13. X-rays were discovered by:
 - a. W. C. Roentgen
 - b. Madam Curie
 - c. Henrey Becquerel
 - d. Albert Einstein
14. X-rays cause:
 - a. Ionization of gases
 - b. Photographic effect in silver halide crystals
 - c. Fluorescence in certain crystals
 - d. All of the above

Regn. No. DD.....

Paper Code: BRIT203

B.Sc. MEDICAL TECHNOLOGY (RADIOGRAPHY & IMAGING)
SECOND YEAR EXAMINATION, AUGUST - 2019
RADIOGRAPHY - I
PAPER - III

[Time allotted: Three hours]

[Max Marks: 70]

Note: Attempt all questions
Draw suitable diagrams wherever necessary

A : Short answer questions:

(7 x 9 = 63)

- Q. 1. Describe technique for X-ray chest PA & lateral view in 26 years married female.
- Q. 2. Write short notes on:
a. Basic views for ankle joint
b. Frog leg lateral view
- Q. 3. What are the preparations for abdominal radiological investigation? Write a note on x-ray abdomen left lateral decubitus view.
- Q. 4. Write short notes on:
a. Ball catcher view
b. C-spine radiography
- Q. 5. Define intravenous urography. Write indications, contraindications and preparation required for this investigation.
- Q. 6. Write short notes on:
a. ALARA Principle
b. Apicogram
- Q. 7. Describe important principles of radiation protection.
- Q. 8. Discuss on warning signs that has to be displayed at a diagnostic x-ray room.
- Q. 9. Describe in detail the radiography of shoulder joint.

B.Sc. MEDICAL TECHNOLOGY (RADIOGRAPHY & IMAGING)
SECOND YEAR EXAMINATION, AUGUST - 2019
RADIOGRAPHY - I
PAPER - III (MCQ)

Time allotted for MCQ - 15 minutes

B : MCQs (Single response type):

(½ x 14 = 7)

Select the most appropriate answer and encircle the alphabet against it

1. If a patient is laying face down, slightly rotated with his left side against the table. This position is known as:
 - a. LAO
 - b. LPO
 - c. RAO
 - d. RPO
2. Which of the term mean to draw away from the body?
 - a. Adduct
 - b. Abduct
 - c. Evert
 - d. Flexion
3. Examination of this body part is done using low KVP:
 - a. Small bowel
 - b. Large bowel
 - c. Liver
 - d. Kidney
4. Which part of rib articulate with transverse process of vertebra?
 - a. Shaft
 - b. Head
 - c. Tubercle
 - d. Neck
5. Which of the following is result of ureteral obstruction?
 - a. Pyelonephrosis
 - b. Nephroptosis
 - c. Hydronephrosis
 - d. Cystourethritis
6. The term that refers to parts closer to the source or beginning:
 - a. Proximal
 - b. Distal
 - c. Caudal
 - d. Cephalad
7. How many phalanges are in the thumb?
 - a. Four
 - b. Three
 - c. Two
 - d. One
8. Horizontal part of mandible is known as:
 - a. Body
 - b. Ramus
 - c. Alveolar process
 - d. Condylod process
9. Sunrise view is done to see:
 - a. Olecranon process
 - b. Radial head
 - c. Patella
 - d. All of the above
10. Judet view is done for:
 - a. Acetabular fracture
 - b. Glenoid fracture
 - c. Lumbar spine fracture
 - d. None of the above
11. An ideal view for Hill Sach lesion is:
 - a. A P Glenoid external rotation
 - b. A P shoulder external rotation
 - c. A P shoulder internal rotation
 - d. None of the above
12. Best projection to demonstrate maxillary sinus is:
 - a. Stenver view
 - b. Towne's view
 - c. Caldwell view
 - d. Water's view
13. Orbitomeatal line is also known as:
 - a. Canthomeatal line
 - b. Mentomeatal line
 - c. Acanthiomeatal line
 - d. None of the above
14. What is synonym for supine position in radiology?
 - a. Ventral recumbent
 - b. Dorsal recumbent
 - c. Lateral recumbent
 - d. None of the above

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B.Sc. MEDICAL TECHNOLOGY (RADIOGRAPHY AND IMAGING)
SECOND YEAR EXAMINATION, NOVEMBER - 2019
RADIOGRAPHIC PHOTOGRAPHY
PAPER - I

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[Time allotted: Three hours]

[Max Marks: 70]

Note: Attempt all questions

Draw suitable diagrams wherever necessary

A : Short answer questions:

(7 x 9 = 63)

Q. 1. What are different layers contained in a radiography film? Write the function of each.

Q. 2. Write short notes on:

- a. Characteristic curve
- b. Intensifying screen

Q. 3. Write short notes on:

- a. X-ray cassette
- b. X-ray fixer

Q. 4. Write short notes on:

- a. Dry view cameras
- b. Viewing accessories

Q. 5. Discuss various types of film fault and their causes.

Q. 6. What is replenishment in film processing? Why is it needed?

Q. 7. What is magnification? How does it affect the image?

Q. 8. Define optical density. Discuss its relation with radiation exposure.

Q. 9. What is geometric un-sharpness? Describe its various sources.

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**B.Sc. MEDICAL TECHNOLOGY (RADIOGRAPHY AND IMAGING)
SECOND YEAR EXAMINATION, NOVEMBER - 2019
RADIOGRAPHIC PHOTOGRAPHY**

**PAPER - I
(MCQ)**

[Time allotted for MCQ - 15 minutes]

B : MCQs (Single response type):

(½ x 14 = 7)

Select the most appropriate answer and encircle the alphabet against it.

1. Lead equivalence of the walls of an x-ray room should be at least:
 - a. 0.5 mm
 - b. 1.5 mm
 - c. 2.5 mm
 - d. 3.0 mm
2. Latent image on a film is formed of the clumps of:
 - a. Calcium
 - b. Potassium
 - c. Sodium
 - d. Silver
3. The radio sensitive material in an x-ray film is:
 - a. Gelatin
 - b. Protective coat
 - c. Silver halide
 - d. Base
4. By increasing Kv, contrast on the image:
 - a. Reduces
 - b. Increases
 - c. Varies randomly
 - d. Remains unaffected
5. The back side of x-ray cassette is made of:
 - a. Aluminum
 - b. Tungsten
 - c. Lead
 - d. Molybdenum
6. What is produced on the image due to scattered radiation?
 - a. Un-sharpness
 - b. Fog
 - c. Poor latitude
 - d. All of these
7. "Hypo" is a:
 - a. Developing agent
 - b. Fixing agent
 - c. Preservative
 - d. All of the above
8. Restrainer mammography film is a:
 - a. Single screen
 - b. Double screen
 - c. Without screen
 - d. All types
9. Rare earth phosphor IF screen are used to increase:
 - a. Contrast
 - b. Sharpness
 - c. Latitude
 - d. Speed
10. Characteristic curve of radiography film is:
 - a. "U" shaped
 - b. "V" shaped
 - c. "S" shaped
 - d. "C" shaped
11. Which process is acidic in nature?
 - a. Development
 - b. Replenishment
 - c. Fixation
 - d. None of these
12. Lanthanum oxybromide is:
 - a. TLD material
 - b. Film Emulsion
 - c. Rare-earth phosphor
 - d. None of these
13. Magnified images are:
 - a. More unsharp
 - b. Less unsharp
 - c. Depends on tissue density
 - d. Neither
14. The image unsharpness is caused by:
 - a. Geometry
 - b. Movement
 - c. Absorption
 - d. All of the above

Regn. No.....

Paper Code: BRIT202

B.Sc. MEDICAL TECHNOLOGY (RADIOGRAPHY & IMAGING)
SECOND YEAR EXAMINATION, NOVEMBER - 2019
MEDICAL PHYSICS & EQUIPMENTS
PAPER - II

[Time allotted: Three hours]

[Max Marks: 70]

Note: Attempt all questions
Draw suitable diagrams wherever necessary

A : Short answer questions:

(7 x 9 = 63)

- Q. 1. Describe briefly the principle of an image intensifier.
- Q. 2. Discuss how x-ray production takes place. Discuss common causes of x-ray tube faults.
- Q. 3. Discuss the effect of scattered radiation on radiographic image quality and staff dose.
- Q. 4. Discuss the requirement and role of rectification in x-ray circuitry.
- Q. 5. Discuss the working of a step-up transformer and mention its role in x-ray circuit.
- Q. 6. Discuss various radiation protection measures taken during fluroscopy imaging.
- Q. 7. Draw a neat diagram of a mammography x-ray tube and show its parts.
- Q. 8. State various radiation safety measures used by a radiographer in mobile radiography.
- Q. 9. What are the factors affecting the intensity of an x-ray beam?

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B.Sc. MEDICAL TECHNOLOGY (RADIOGRAPHY & IMAGING)
SECOND YEAR EXAMINATION, NOVEMBER - 2019
MEDICAL PHYSICS & EQUIPMENTS
PAPER - II
(MCQ)

Time allotted for MCQ - 15 minutes

B : MCQs (Single response type):

(½ x 14 = 7)

Select the most appropriate answer and **encircle** the alphabet against it.

1. Cathode in an x-ray tube is heated by:
 - a. Tube current
 - b. Filament current
 - c. Thermostats
 - d. Superconductivity
2. Cathode focusing cups are provided in x-ray tubes to:
 - a. Focus x-rays towards patient
 - b. Minimize heel effect
 - c. Focus electrons on the target
 - d. Maintain vacuum in the tube
3. Rectifiers are provided in x-ray circuits:
 - a. To keep tube's filament from being damaged
 - b. To prevent the wastage of incoming power
 - c. Both a and b
 - d. None of the above
4. Transformers are based on:
 - a. Coulomb's law
 - b. Faraday's laws
 - c. Ohm's law
 - d. Kirchhoff's laws
5. Grid cutoff is mainly seen in:
 - a. Parallel grids
 - b. Focused grids
 - c. Stationary grids
 - d. Moving grids
6. The device **not** related to patient dose reduction is:
 - a. Intensifying screen
 - b. Filter
 - c. Grid
 - d. Collimator
7. The television camera used with fluoroscopy image intensifier is a:
 - a. Digital camera
 - b. Vidicon camera
 - c. Movie camera
 - d. Video camera
8. In a fluoroscopy image intensifier the image is carried from the input phosphor to output phosphor by:
 - a. Protons
 - b. Electrons
 - c. X-ray photons
 - d. Light photons
9. Image brightness in image intensifier is attributed to:
 - a. Minification gain
 - b. Flux gain
 - c. Both a and b
 - d. None of the above
10. In fluoroscopy imaging, the spot film is positioned between:
 - a. Image intensifier and TV camera
 - b. X-ray tube and patient
 - c. TV camera and television
 - d. Patient and image intensifier
11. A bar pattern test tool is used to find out:
 - a. Total filtration used in the x-ray machine
 - b. The size of focal spot
 - c. Mismatch between optical and radiation fields
 - d. Beam perpendicularity
12. Beryllium window is provided in x-ray tubes of:
 - a. Radiography
 - b. Fluoroscopy
 - c. Mammography
 - d. Dental radiography
13. Filament circuit uses:
 - a. High voltage
 - b. Low voltage
 - c. Medium voltage
 - d. No voltage
14. During x-ray production, what percentage of energy is converted into heat?
 - a. 1 %
 - b. 25 %
 - c. 50 %
 - d. 99 %

**B.Sc. MEDICAL TECHNOLOGY (RADIOGRAPHY AND IMAGING)
SECOND YEAR EXAMINATION, AUGUST - 2020
RADIOGRAPHIC PHOTOGRAPHY
PAPER - I**

[Time allotted: Two hours]

[Max Marks: 70]

Note: Attempt all questions

Draw suitable diagram wherever necessary

A : Short answer questions:

(06 x 10 = 60)

- Q. 1.** Discuss the formation of latent image on radiographic film.
- Q. 2.** What are different layers contained in a radiography film? Write the function of each.
- Q. 3.** Enumerate various precautions used to handle films in darkroom.
- Q. 4.** Define optical density. Discuss its relation with radiation exposure.
- Q. 5.** What is H & D curve? What are its different features?
- Q. 6.** Why intensifying screens are used? Define intensification factor.

B.Sc. MEDICAL TECHNOLOGY (RADIOGRAPHY AND IMAGING)
SECOND YEAR EXAMINATION, AUGUST - 2020
RADIOGRAPHIC PHOTOGRAPHY
PAPER - I
(MCQ)

Time allotted for MCQ - 15 minutes

B : MCQs (Single response type):

(01 x 10 = 10)

Select the most appropriate answer and encircle the alphabet against it

1. The light sensitive layer in radiography film is:
 - a. Emulsion
 - b. Base
 - c. Super coat
 - d. None of the above
2. Mammography films are:
 - a. Single coated
 - b. Double coated
 - c. May be both types
 - d. Uncoated
3. Radiographic films are double coated to increase:
 - a. Contrast
 - b. Sharpness
 - c. Resolution
 - d. Latitude
4. Characteristic curve of radiography film is:
 - a. U-shaped
 - b. V-shaped
 - c. S-shaped
 - d. C-shaped
5. Range of exposure to obtain useful densities of the film is known as:
 - a. Film gamma
 - b. Speed
 - c. Latitude
 - d. None of these
6. Which one of the following is not inferred from H & D curve?
 - a. Contrast
 - b. Speed
 - c. Latitude
 - d. Noise
7. Intensifying screen is based on the principle of:
 - a. Oxidation
 - b. Reduction
 - c. Photosynthesis
 - d. Luminescence
8. Film fog is due to:
 - a. Scattered radiation
 - b. Improper processing
 - c. Both a and b
 - d. None of these
9. Improper film-screen contact reduces:
 - a. Contrast
 - b. Resolution
 - c. Sharpness
 - d. Speed
10. Which process is acidic in nature?
 - a. Development
 - b. Replenishment
 - c. Fixation
 - d. None of these

**B.Sc. MEDICAL TECHNOLOGY (RADIOGRAPHY & IMAGING)
SECOND YEAR EXAMINATION, AUGUST - 2020
MEDICAL PHYSICS & EQUIPMENTS
PAPER - II**

[Time allotted: Two hours]

[Max Marks: 70]

Note: Attempt all questions.

Draw suitable diagrams wherever necessary.

A : Short answer questions:

(01 x 10 = 60)

- Q. 1. Draw a neat diagram of radiography X-ray tube and show its various parts.
- Q. 2. What is line focus principle and why it is used?
- Q. 3. What is self-rectification of X-ray tube? Why are rectifiers used in X-ray generator circuit?
- Q. 4. Discuss the means to prevent scattered radiation in radiography.
- Q. 5. What is the principle of working of transformer? Mention different types of transformers.
- Q. 6. What is fluoroscopic imaging? Discuss the role of image intensifier in it.

B.Sc. MEDICAL TECHNOLOGY (RADIOGRAPHY & IMAGING)
SECOND YEAR EXAMINATION, AUGUST - 2020
MEDICAL PHYSICS & EQUIPMENTS
PAPER - II
(MCQ)

Time allotted for MCQ - 15 minutes

B : MCQs (Single response type):

(01 x 10= 10)

Select the most appropriate answer and **encircle** the alphabet against it

1. Filament circuit uses:
 - a. High voltage
 - b. Low voltage
 - c. Medium voltage
 - d. No voltage
2. During X-ray production, what percentage of energy is converted into heat?
 - a. 1%
 - b. 25%
 - c. 50%
 - d. 99%
3. Beryllium widow is used in:
 - a. Radiography tubes
 - b. CT tubes
 - c. Portable x-ray tubes
 - d. Mammography tubes
4. X-ray circuit employs:
 - a. Step-up transformer
 - b. Step-down transformer
 - c. Auto-transformer
 - d. All of the above
5. Which one of the following generator gives lowest ripple?
 - a. Half wave rectified
 - b. Full wave rectified
 - c. Three phase
 - d. Constant potential
6. Which one of the following is most suitable for beam shaping?
 - a. Aperture diaphragm
 - b. Cone
 - c. Cylinder
 - d. Collimator
7. Which type of grid is commonly used in diagnostic radiography?
 - a. Focused
 - b. Crossed
 - c. Parallel
 - d. None of the above
8. "Brightness gain" is related to:
 - a. Darkroom safe light
 - b. View box
 - c. Radiography film
 - d. Image intensifier
9. A grid is more efficient if it has:
 - a. High grid ratio
 - b. Low grid ratio
 - c. Medium grid ratio
 - d. None of the above
10. Use of grid:
 - a. Increases patient dose
 - b. Reduces scattered radiation
 - c. Improves image contrast
 - d. All of the above

Regn. No. DD.....

Paper Code: BRIT203

**B.Sc. MEDICAL TECHNOLOGY (RADIOGRAPHY & IMAGING)
SECOND YEAR EXAMINATION, AUGUST - 2020
RADIOGRAPHY - I
PAPER - III**

[Time allotted: Two hours]

[Max Marks: 70]

Note: Attempt all questions

Draw suitable diagrams wherever necessary

A : Short answer questions:

(06 x 10 = 60)

- Q. 1.** What are the terms used for movement?
- Q. 2.** Define the anatomical planes and draw the related diagram.
- Q. 3.** What are the special terms for limbs positioning?
- Q. 4.** What are the functions of bones?
- Q. 5.** Write the classification of bones.
- Q. 6.** Write the nerve supply of the bones.

B.Sc. MEDICAL TECHNOLOGY (RADIOGRAPHY & IMAGING)
SECOND YEAR EXAMINATION, AUGUST - 2020
RADIOGRAPHY - I
PAPER - III
(MCQ)

Time allotted for MCQ - 15 minutes

B : MCQs (Single response type):

(01 x 10 = 10)

Select the most appropriate answer and **encircle** the alphabet against it

1. The largest of the tarsal bone is termed as:
 - a. Talus
 - b. Calcaneus
 - c. Cuboid
 - d. Navicular
2. The focus film distance in the x-ray of heart and aorta is:
 - a. 120cm
 - b. 100cm
 - c. 150cm
 - d. 180cm
3. Subtalar joint is between the:
 - a. Tibia and fibula
 - b. Talus and fibula
 - c. Talus and calcaneus
 - d. Talus and tibia
4. The line from the lowest point on inferior orbital margin to upper border of external auditory meatus is called:
 - a. Auricular line
 - b. Inter-orbital line
 - c. OMB line
 - d. Anthropological base line
5. Bones on each hand and wrist are:
 - a. 26
 - b. 27
 - c. 28
 - d. 25
6. Cone view is specially used in the following X-ray **except**:
 - a. Spine
 - b. Optic foramina
 - c. Mastoid
 - d. KUB
7. MP joints and CM joints are used to describe the:
 - a. Hand
 - b. Face
 - c. Head
 - d. Hip
8. Single hip lateral x-ray is taken by rotating the patient:
 - a. 25° to the site being examined
 - b. 25° anteriorly
 - c. 45° to the site being examined
 - d. 25° posteriorly
9. In AO view of sternum, the patient is rotated to:
 - a. 10°
 - b. 20°-30° either side
 - c. 20° left
 - d. 15° right
10. X-ray projection knee intercondylar fossa is taken in:
 - a. PA
 - b. AP
 - c. Tunnel
 - d. Oblique

Regn. No.....

Paper Code: BRIT-201...

B.Sc. MEDICAL TECHNOLOGY (RADIOGRAPHY AND IMAGING)
SECOND YEAR EXAMINATION, JULY - 2018
RADIOGRAPHIC PHOTOGRAPHY
PAPER - I

[Time allotted: Three hours]

[Max Marks: 70]

Note: Attempt all questions

Draw suitable diagram wherever necessary

A : Short answer questions:

(7 x 9 = 63)

- Q. 1.** What are different layers contained in a radiography film? Write the function of each.
- Q. 2.** Describe the process latent image formation on X-ray films.
- Q. 3.** Mention various safety aspects related to storage of radiographic films in darkroom.
- Q. 4.** Define photographic density. What is its relation with exposure?
- Q. 5.** Why are intensifying screens used in x- ray imaging? Highlight its different layers and their roles in it.
- Q. 6.** What is replenishment in film processing? Why it is needed?
- Q. 7.** Define luminescence. Describe the device based on luminescence used in a radiology department.
- Q. 8.** What is the source of quantum mottle in radiographic images? On what factors does it depend?
- Q. 9.** What is geometric unsharpness? Describe its various sources.

B.Sc. MEDICAL TECHNOLOGY (RADIOGRAPHY AND IMAGING)
SECOND YEAR EXAMINATION, JULY - 2018
RADIOGRAPHIC PHOTOGRAPHY
PAPER - I (MCQ)

Time allotted for MCQ-15 minutes

B : MCQs (Single response type):

(½ x 14= 7)

Select the most appropriate answer and **encircle** the alphabet against it

1. Lead equivalence of the walls of an x-ray room should be at least:
 - a. 0.5 mm
 - b. 1.5 mm
 - c. 2.5 mm
 - d. 3.0 mm
2. The color of safe light used in x-ray dark rooms is:
 - a. Red
 - b. Green
 - c. Blue
 - d. Any color
3. By increasing Kv, contrast of the image:
 - a. Increases
 - b. Decreases
 - c. Remain unchanged
 - d. Fluctuates randomly
4. Development of unexposed silver on a radiography film results in:
 - a. Image noise
 - b. Image unsharpness
 - c. Film fog
 - d. None of these
5. Film contrast and latitude are:
 - a. Directly related
 - b. Inversely related
 - c. Exponentially related
 - d. None of these
6. Statistical fluctuation of X-ray photons in the beam produces :
 - a. Quantum mottle
 - b. Heel effect
 - c. Increase in patient dose
 - d. None of these
7. A film characteristic curve does not give information about:
 - a. Contrast
 - b. Speed
 - c. Latitude
 - d. Kv
8. The process of film development is:
 - a. Oxidation
 - b. Reduction
 - c. Ionization
 - d. Dehydration
9. Mammography film is a:
 - a. Single screen
 - b. Double screen
 - c. Without screen
 - d. All types
10. "Hypo" is a:
 - a. Developing agent
 - b. Fixing agent
 - c. Replenisher
 - d. Preservative
11. This is an antifogging agent used in manual processing:
 - a. Hydroquinone
 - b. Sodium carbonate
 - c. Sodium sulfite
 - d. Potassium bromide
12. Lanthanum oxybromide is a:
 - a. TLD material
 - b. Film emulsion
 - c. Rare earth phosphor
 - d. None of these
13. Radiographic films are double coated to increase:
 - a. Contrast
 - b. Sharpness
 - c. Resolution
 - d. Latitude
14. Characteristic curve of radiography film is:
 - a. U-shaped
 - b. V-shaped
 - c. S-shaped
 - d. C-shaped

Regn. No.....

Paper Code: BRIT-202...

B.Sc. MEDICAL TECHNOLOGY (RADIOGRAPHY & IMAGING)
SECOND YEAR EXAMINATION, JULY - 2018
MEDICAL PHYSICS & EQUIPMENTS
PAPER - II

[Time allotted : Three hours]

[Max Marks : 70]

Note: Attempt all questions.

Draw suitable diagrams wherever necessary.

A : Short answer questions:

(7 x 9 = 63)

- Q. 1. Write about planning consideration for installation of a 500 mA X-ray machine.
- Q. 2. Describe photoelectric effect and its application in diagnostic radiology.
- Q. 3. Explain parameters affecting scatter radiation and methods to reduce it.
- Q. 4. Draw a labelled diagram showing modern diagnostic X-ray tube and electric circuit of X-ray generators.
- Q. 5. What is digital radiography? Discuss its advantages and disadvantages.
- Q. 6. List the factors contributing reduced radiation dose to patient and operator.
- Q. 7. Define basic units of radiation exposure. List recommended dose limits for a radiation worker and for general public.
- Q. 8. Describe the structure and types of intensifying screens. List advantages and disadvantages of their use.
- Q. 9. Explain factors affecting quality of radiographs.

B.Sc. MEDICAL TECHNOLOGY (RADIOGRAPHY & IMAGING)
SECOND YEAR EXAMINATION, JULY - 2018
MEDICAL PHYSICS & EQUIPMENTS
PAPER - II (MCQ)

Time allotted for MCQ-15 minutes

B : MCQs (Single response type):

($\frac{1}{2} \times 14 = 7$)

Select the most appropriate answer and **encircle** the alphabet against it

1. Who discovered X-rays?
 - a. Wilhelm Conrad Roentgen
 - b. Normann
 - c. William Harvey
 - d. J J Thomson
2. Quantity of X-rays produced does **not** depend on:
 - a. Atomic number of target material
 - b. Atomic mass of the target material
 - c. Square of kVp
 - d. Milli amperes of X-ray tube
3. A device that allows electric current to flow only in one direction is known as:
 - a. Filter
 - b. Grid
 - c. Rectifier
 - d. Intensifying screen
4. Which is **true** about photoelectric effect?
 - a. Photoelectric effect is directly proportional to square root of atomic number
 - b. Photoelectric effect is directly proportional to square of atomic number
 - c. Photoelectric effect is directly proportional to cube of atomic number
 - d. Photoelectric effect is inversely proportional to atomic number
5. Attenuation does **not** depend on:
 - a. Atomic number
 - b. Density
 - c. Electrons / gram
 - d. kVp
6. What is the most important ingredient of photographic emulsion?
 - a. Gelatin and silver halide
 - b. Only silver halide
 - c. None of the above
 - d. Only gelatin
7. Dose equivalent is measured in:
 - a. Coulombs
 - b. Grays
 - c. Sieverts (Sv)
 - d. Man-sieverts
8. The effective dose from a PA chest examination is typically:
 - a. 2 msv
 - b. 20 msv
 - c. 0.02 msv
 - d. 0.2 msv
9. Ways to improve contrast in tissue are all **except**:
 - a. Reduce kV
 - b. Increase mA
 - c. Use grids
 - d. Contrast media
10. Regarding TLD, which is true?
 - a. Uses lithium fluoride as active ingredient
 - b. Used for whole body dosage
 - c. Cannot be reduced
 - d. Permanent records achieved
11. Protective devices in radiography rooms are made of:
 - a. Silver
 - b. Tungsten
 - c. Lead
 - d. Molybdenum
12. Regarding tungsten as target, all are true **except**:
 - a. High melting point
 - b. High vapour pressure
 - c. High thermal conductivity
 - d. High atomic number
13. Increasing the kilovoltage setting for an exposure will:
 - a. Reduce the skin dose and improve contrast
 - b. Increase skin dose and improve contrast
 - c. Reduce skin dose
 - d. Increase sharpness
14. Factors affecting scatter radiation are:
 - a. kVp
 - b. Part thickness
 - c. Field size
 - d. All of the above

Regn. No.....

Paper Code: BRIT-203...

B.Sc. MEDICAL TECHNOLOGY (RADIOGRAPHY & IMAGING)
SECOND YEAR EXAMINATION, JULY - 2018
RADIOGRAPHY (I)
PAPER - III

[Time allotted : Three hours]

[Max Marks : 70]

Note: Attempt all questions

Draw suitable diagrams wherever necessary

A : Short answer questions:

(7 x 9 = 63)

- Q. 1. Write the radiography method for lower extremity including pelvis.
- Q. 2. Discuss any five practical methods of reducing radiation dose to patient.
- Q. 3. Describe the checklist for an X-ray unit to perform speedy investigation.
- Q. 4. Briefly write the methods for X-ray sacrum and coccyx.
- Q. 5. What are different considerations to carry out radiological investigation of an MLC patient?
- Q. 6. Describe the radiological anatomy of pelvis and technique of radiography of pelvic girdle.
- Q. 7. Discuss radiography techniques of vertebral columns and abdomen.
- Q. 8. Describe the advantages and disadvantages of macro-radiography.
- Q. 9. Write short notes on:
 - a. CT abdomen
 - b. 10 days rule

(3.5 x 2)

Regn. No.....

Paper Code: BRIT-203...

B.Sc. MEDICAL TECHNOLOGY (RADIOGRAPHY & IMAGING)

SECOND YEAR EXAMINATION, JULY - 2018

RADIOGRAPHY (I)

PAPER - III (MCQ)

Time allotted for MCQ-15 minutes

(½ x 14 = 7)

B : MCQs (Single response type):

Select the most appropriate answer and **encircle** the alphabet against it

1. Subtalar joint is between the:
 - a. Tibia and fibula
 - b. Talus and fibula
 - c. Talus and calcaneus
 - d. Talus and tibia
2. The largest of the tarsal bone is termed as:
 - a. Talus
 - b. Calcaneus
 - c. Cuboid
 - d. Navicular
3. MP joints and CM joints are used to describe the:
 - a. Hand
 - b. Face
 - c. Head
 - d. Hip
4. The line from the lowest point on inferior orbital margin to upper border of external auditory meatus is called:
 - a. Auricular line
 - b. Inter-orbital line
 - c. OMB line
 - d. Anthropological base line
5. X-ray projection knee intercondylar fossa is taken in:
 - a. PA
 - b. AP
 - c. Tunnel
 - d. Oblique
6. Bones on each hand and wrist are:
 - a. 26
 - b. 27
 - c. 28
 - d. 25
7. Sunrise view is used to see the:
 - a. Femoral condyles
 - b. Patella
 - c. Tibial condyle
 - d. Fibular head
8. Which projection shows the coronoid process free of superimposition?
 - a. AP elbow
 - b. Lateral oblique elbow
 - c. Medial oblique
 - d. AP forearm
9. The spine of the scapula is on which side?
 - a. Lateral
 - b. Medial
 - c. Posterior
 - d. Inferior
10. Rotation of the forearm showing the palm facing down is called:
 - a. Hyperflexion
 - b. Inversion
 - c. Supination
 - d. Pronation
11. The wrist bones are known as:
 - a. Carpals
 - b. Metacarpals
 - c. Tarsals
 - d. Phalanges
12. In portable radiography, minimum distance between X-ray source and radiographer should be:
 - a. 1 meter
 - b. 2 meter
 - c. 3 meter
 - d. 4 meter
13. BMD stands for:
 - a. Body mass development
 - b. Bone meter dimension
 - c. Bone mineral density
 - d. None of the above
14. Non-grid techniques are used for:
 - a. Adult patients
 - b. Pediatric patients
 - c. Geriatric patients
 - d. Female patients

Regn. No. DD.....

Paper Code: BRIT201

**B.Sc. MEDICAL TECHNOLOGY (RADIOGRAPHY AND IMAGING)
SECOND YEAR EXAMINATION, AUGUST - 2019
RADIOGRAPHIC PHOTOGRAPHY
PAPER - I**

[Time allotted: Three hours]

[Max Marks: 70]

Note: Attempt all questions

Draw suitable diagram wherever necessary

A : Short answer questions:

(7 x 9 = 63)

- Q. 1.** What is intensification factor? What does it indicate?
- Q. 2.** Write various safety constraints used in the layout and planning of a radiology darkroom.
- Q. 3.** Briefly discuss about the different ingredients of an automatic developer.
- Q. 4.** Define luminescence. Mention the use of luminescence in a radiology department.
- Q. 5.** Define optical density produced on a radiography film. What is its relation with radiation exposure?
- Q. 6.** Define the characteristic curve of a radiography film. What information does it give?
- Q. 7.** Describe general types of film faults and their causes.
- Q. 8.** Describe the influence of kV and scattered radiation on image quality.
- Q. 9.** Discuss the process of latent image formation.

B.Sc. MEDICAL TECHNOLOGY (RADIOGRAPHY AND IMAGING)
SECOND YEAR EXAMINATION, AUGUST - 2019
RADIOGRAPHIC PHOTOGRAPHY
PAPER - I (MCQ)

Time allotted for MCQ - 15 minutes

B : MCQs (Single response type):

(½ x 14 = 7)

Select the most appropriate answer and encircle the alphabet against it.

1. Lead equivalence of the walls of an x-ray room should be at least:
 - a. 0.5 mm
 - b. 1.5 mm
 - c. 2.5 mm
 - ☒ d. 3.0 mm
2. The color of safe light used in x-ray dark rooms is:
 - a. Red
 - b. Green
 - c. Blue
 - d. Any color
3. The radiosensitive material in an x-ray film is:
 - a. Gelatin
 - b. Adhesive layer
 - c. Silver halide
 - d. Base
4. Mammography film is a:
 - a. Single screen
 - b. Double screen
 - c. Without screen
 - d. All types
5. The back side of an x-ray cassette is made of:
 - ☒ a. Aluminum
 - b. Tungsten
 - c. Lead
 - d. Molybdenum
6. The role of intensifying screens is to:
 - a. Reduce patient dose
 - b. Improve image quality
 - c. To hold the film
 - d. All of the above
7. Phosphor of IF screens contain:
 - a. Tissue equivalent material
 - b. Silver halide
 - c. Hydrogen peroxide
 - d. Tungsten
8. Rare earth phosphor IF screens are used to increase:
 - a. Contrast
 - b. Sharpness
 - c. Latitude
 - d. Speed
9. An antifogging agent used in manual processing:
 - a. Hydroquinone
 - b. Sodium carbonate
 - c. Sodium sulfite
 - d. Potassium bromide
10. With manual development, radiographic exposure is based on time and temperature as:
 - a. 5 min, 40°C
 - b. 10 min, 40°C
 - c. 5 min, 20°C
 - d. 10 min, 20°C
11. X-ray film boxes should be stored in the darkroom in the position:
 - a. Flat one upon another
 - b. Upright
 - c. Hanging
 - d. Tilted
12. What is produced on the image due to scattered radiation?
 - a. Un-sharpness
 - b. Fog
 - c. Poor latitude
 - d. All of these
13. "Hypo" is a:
 - a. Developing agent
 - b. Fixing agent
 - c. Preservative
 - d. Restrainer
14. Pass box of the dark room should have lead equivalent of:
 - a. 1 mm Pb
 - b. 0.5 mm Pb
 - c. 0.25 mm Pb
 - d. 2.5 mm Pb

B.Sc. MEDICAL TECHNOLOGY (RADIOGRAPHY & IMAGING)
SECOND YEAR EXAMINATION, AUGUST 2019
MEDICAL PHYSICS & EQUIPMENTS
PAPER - II

[Time allotted: Three hours]

[Max Marks: 70]

Note: Attempt all questions.

Draw suitable diagrams wherever necessary.

A : Short answer questions:

(7 x 9 = 63)

- Q. 1. What are various aims of quality assurance of a radiological facility? Briefly discuss about any two tests that you perform during operational phase of radiography unit.
- Q. 2. Briefly describe the basic principle of tomography.
- Q. 3. Describe the composition and structure of radiography grids. What grid ratio indicates?
- Q. 4. Briefly discuss ICRP principles of radiation protection. Define LET and MPD.
- Q. 5. Briefly discuss the health effect of ionizing radiation.
- Q. 6. Write short notes on:
a. Common x-ray tube faults
b. High tension transformer
- Q. 7. Define the following:
a. Bremsstrahlung radiation
b. Potter bucky grid
- Q. 8. Define image quality. Write various aspects of radiographic image quality.
- Q. 9. Define the principle of line focus in x-ray tubes. What is its utility?

Regn. No. DD.....

Paper Code: BRIT202

B.Sc. MEDICAL TECHNOLOGY (RADIOGRAPHY & IMAGING)
SECOND YEAR EXAMINATION, AUGUST - 2019
MEDICAL PHYSICS & EQUIPMENTS
PAPER - II (MCQ)

Time allotted for MCQ - 15 minutes

B : MCQs (Single response type):

(½ x 14 = 7)

Select the most appropriate answer and encircle the alphabet against it.

1. Target material of an x-ray tube is made of:
 - a. Low Z high melting point material
 - b. Medium Z low melting point material
 - c. High Z high melting point material
 - d. Low Z low melting point material
2. Mas is related to:
 - a. Penetration power of the beam
 - b. Radiation exposure
 - c. Scatter radiation
 - d. None of the above
3. What is responsible of 'Heel effect' in x-ray images?
 - a. Focusing cups
 - b. Anode angle
 - c. Small focal spot
 - d. Added filters
4. Target material mostly used in mammography tubes is:
 - a. Molybdenum
 - b. Beryllium
 - c. Pyrex
 - d. Silicon
5. Rotating anode in x-ray tube is used to:
 - a. Reduce scatter radiation
 - b. Increase target heat loading capacities
 - c. Increase x-ray intensity
 - d. All of the above
6. Grids:
 - a. Reduce scatter
 - b. Increase patient dose
 - c. Contain lead
 - d. All of the above
7. Optimum lead equivalency of a lead apron is:
 - a. 0.5 cm
 - b. 1 cm
 - c. 0.5 mm
 - d. 1 mm
8. Image intensifier contains:
 - a. Bigger input and smaller output phosphors
 - b. Smaller input and bigger output phosphors
 - c. Both same in size
 - d. It depends on image intensifier
9. In mobile radiography an infirm patient is supported (if required) by:
 - a. Radiographer
 - b. Patient's attendant
 - c. Radiography student
 - d. No one
10. A dental film is a:
 - a. Non screen double emulsion
 - b. Single screen double emulsion
 - c. Single screen single emulsion
 - d. Double screen double emulsion
11. During portable x-rays the distance of the radiographer from the patient should be at least:
 - a. 2 feet
 - b. 3 feet
 - c. 1 meter
 - d. 2 meters
12. A quality controlled radiography unit produces:
 - a. Good image quality
 - b. Reduced patient dose
 - c. Staff convenience
 - d. All of the above
13. X-rays were discovered by:
 - a. W. C. Roentgen
 - b. Madam Curie
 - c. Henry Becquerel
 - d. Albert Einstein
14. X-rays cause:
 - a. Ionization of gases
 - b. Photographic effect in silver halide crystals
 - c. Fluorescence in certain crystals
 - d. All of the above

Regn. No. DD.....

Paper Code: BRIT203

B.Sc. MEDICAL TECHNOLOGY (RADIOGRAPHY & IMAGING)
SECOND YEAR EXAMINATION, AUGUST - 2019
RADIOGRAPHY - I
PAPER - III

[Time allotted: Three hours]

[Max Marks: 70]

Note: Attempt all questions

Draw suitable diagrams wherever necessary

(7 x 9 = 63)

A : Short answer questions:

Q. 1. Describe technique for X-ray chest PA & lateral view in 26 years married female.

- Q. 2.** Write short notes on:
- a. Basic views for ankle joint
 - b. Frog leg lateral view

Q. 3. What are the preparations for abdominal radiological investigation? Write a note on x-ray abdomen left lateral decubitus view.

- Q. 4.** Write short notes on:
- a. Ball catcher view
 - b. C-spine radiography

Q. 5. Define intravenous urography. Write indications, contraindications and preparation required for this investigation.

- Q. 6.** Write short notes on:
- a. ALARA Principle
 - b. Apicogram

Q. 7. Describe important principles of radiation protection.

Q. 8. Discuss on warning signs that has to be displayed at a diagnostic x-ray room.

Q. 9. Describe in detail the radiography of shoulder joint.

B.Sc. MEDICAL TECHNOLOGY (RADIOGRAPHY & IMAGING)
SECOND YEAR EXAMINATION, AUGUST - 2019
RADIOGRAPHY - I
PAPER - III (MCQ)

Time allotted for MCQ - 15 minutes

(½ x 14 = 7)

B : MCQs (Single response type):

Select the most appropriate answer and **encircle** the alphabet against it

1. If a patient is laying face down, slightly rotated with his left side against the table. This position is known as:
 - a. LAO
 - b. LPO
 - c. RAO
 - d. RPO
2. Which of the term mean to draw away from the body?
 - a. Adduct
 - b. Abduct
 - c. Evert
 - d. Flexion
3. Examination of this body part is done using low KVP:
 - a. Small bowel
 - b. Large bowel
 - c. Liver
 - d. Kidney
4. Which part of rib articulate with transverse process of vertebra?
 - a. Shaft
 - b. Head
 - c. Tubercle
 - d. Neck
5. Which of the following is result of ureteral obstruction?
 - a. Pyelonephrosis
 - b. Nephroptosis
 - c. Hydronephrosis
 - d. Cystourethritis
6. The term that refers to parts closer to the source or beginning:
 - a. Proximal
 - b. Distal
 - c. Caudal
 - d. Cephalad
7. How many phalanges are in the thumb?
 - a. Four
 - b. Three
 - c. Two
 - d. One
8. Horizontal part of mandible is known as:
 - a. Body
 - b. Ramus
 - c. Alveolar process
 - d. Condylod process
9. Sunrise view is done to see:
 - a. Olecranon process
 - b. Radial head
 - c. Patella
 - d. All of the above
10. Judet view is done for:
 - a. Acetabular fracture
 - b. Glenoid fracture
 - c. Lumbar spine fracture
 - d. None of the above
11. An ideal view for Hill Sach lesion is:
 - a. A P Glenoid external rotation
 - b. A P shoulder external rotation
 - c. A P shoulder internal rotation
 - d. None of the above
12. Best projection to demonstrate maxillary sinus is:
 - a. Stenver view
 - b. Towne's view
 - c. Caldwell view
 - d. Water's view
13. Orbitomeatal line is also known as:
 - a. Canthomeatal line
 - b. Mentomeatal line
 - c. Acanthiomeatal line
 - d. None of the above
14. What is synonym for supine position in radiology?
 - a. Ventral recumbent
 - b. Dorsal recumbent
 - c. Lateral recumbent
 - d. None of the above

Regn. No.....

Paper Code: BRIT201

B.Sc. MEDICAL TECHNOLOGY (RADIOGRAPHY AND IMAGING)
SECOND YEAR EXAMINATION, NOVEMBER - 2019
RADIOGRAPHIC PHOTOGRAPHY
PAPER - I

h/b

[Time allotted: Three hours]

[Max Marks: 70]

Note: Attempt all questions

Draw suitable diagrams wherever necessary

A : Short answer questions:

(7 x 9 = 63)

Q. 1. What are different layers contained in a radiography film? Write the function of each.

Q. 2. Write short notes on:

- a. Characteristic curve
- b. Intensifying screen

Q. 3. Write short notes on:

- a. X-ray cassette
- b. X-ray fixer

Q. 4. Write short notes on:

- a. Dry view cameras
- b. Viewing accessories

Q. 5. Discuss various types of film fault and their causes.

Q. 6. What is replenishment in film processing? Why is it needed?

Q. 7. What is magnification? How does it affect the image?

Q. 8. Define optical density. Discuss its relation with radiation exposure.

Q. 9. What is geometric un-sharpness? Describe its various sources.

Regn. No.....

Paper Code: BRIT201

B.Sc. MEDICAL TECHNOLOGY (RADIOGRAPHY AND IMAGING)
SECOND YEAR EXAMINATION, NOVEMBER - 2019
RADIOGRAPHIC PHOTOGRAPHY
PAPER - I
(MCQ)

[Time allotted for MCQ - 15 minutes]

B : MCQs (Single response type):

(½ x 14 = 7)

Select the most appropriate answer and encircle the alphabet against it.

1. Lead equivalence of the walls of an x-ray room should be at least:
 - a. 0.5 mm
 - b. 1.5 mm
 - c. 2.5 mm
 - d. 3.0 mm
2. Latent image on a film is formed of the clumps of:
 - a. Calcium
 - b. Potassium
 - c. Sodium
 - d. Silver
3. The radio sensitive material in an x-ray film is:
 - a. Gelatin
 - b. Protective coat
 - c. Silver halide
 - d. Base
4. By increasing Kv, contrast on the image:
 - a. Reduces
 - b. Increases
 - c. Varies randomly
 - d. Remains unaffected
5. The back side of x-ray cassette is made of:
 - a. Aluminum
 - b. Tungsten
 - c. Lead
 - d. Molybdenum
6. What is produced on the image due to scattered radiation?
 - a. Un-sharpness
 - b. Fog
 - c. Poor latitude
 - d. All of these
7. "Hypo" is a:
 - a. Developing agent
 - b. Fixing agent
 - c. Preservative
 - d. All of the above
8. Restrainer mammography film is a:
 - a. Single screen
 - b. Double screen
 - c. Without screen
 - d. All types
9. Rare earth phosphor IF screen are used to increase:
 - a. Contrast
 - b. Sharpness
 - c. Latitude
 - d. Speed
10. Characteristic curve of radiography film is:
 - a. "U" shaped
 - b. "V" shaped
 - c. "S" shaped
 - d. "C" shaped
11. Which process is acidic in nature?
 - a. Development
 - b. Replenishment
 - c. Fixation
 - d. None of these
12. Lanthanum oxybromide is:
 - a. TLD material
 - b. Film Emulsion
 - c. Rare-earth phosphor
 - d. None of these
13. Magnified images are:
 - a. More unsharp
 - b. Less unsharp
 - c. Depends on tissue density
 - d. Neither
14. The image unsharpness is caused by:
 - a. Geometry
 - b. Movement
 - c. Absorption
 - d. All of the above

Regn. No.....

Paper Code: BRIT202

B.Sc. MEDICAL TECHNOLOGY (RADIOGRAPHY & IMAGING)
SECOND YEAR EXAMINATION, NOVEMBER - 2019
MEDICAL PHYSICS & EQUIPMENTS
PAPER - II

[Time allotted: Three hours]

[Max Marks: 70]

Note: Attempt all questions
Draw suitable diagrams wherever necessary

A : Short answer questions:

(7 x 9 = 63)

- Q. 1. Describe briefly the principle of an image intensifier.
- Q. 2. Discuss how x-ray production takes place. Discuss common causes of x-ray tube faults.
- Q. 3. Discuss the effect of scattered radiation on radiographic image quality and staff dose.
- Q. 4. Discuss the requirement and role of rectification in x-ray circuitry.
- Q. 5. Discuss the working of a step-up transformer and mention its role in x-ray circuit.
- Q. 6. Discuss various radiation protection measures taken during fluoroscopy imaging.
- Q. 7. Draw a neat diagram of a mammography x-ray tube and show its parts.
- Q. 8. State various radiation safety measures used by a radiographer in mobile radiography.
- Q. 9. What are the factors affecting the intensity of an x-ray beam?

Regn. No.....

Paper Code: BRIT202

B.Sc. MEDICAL TECHNOLOGY (RADIOGRAPHY & IMAGING)
SECOND YEAR EXAMINATION, NOVEMBER - 2019
MEDICAL PHYSICS & EQUIPMENTS
PAPER - II
(MCQ)

Time allotted for MCQ - 15 minutes

B : MCQs (Single response type):

(½ x 14 = 7)

Select the most appropriate answer and **encircle** the alphabet against it.

1. Cathode in an x-ray tube is heated by:
 - a. Tube current
 - b. Filament current
 - c. Thermostats
 - d. Superconductivity
2. Cathode focusing cups are provided in x-ray tubes to:
 - a. Focus x-rays towards patient
 - b. Minimize heel effect
 - c. Focus electrons on the target
 - d. Maintain vacuum in the tube
3. Rectifiers are provided in x-ray circuits:
 - a. To keep tube's filament from being damaged
 - b. To prevent the wastage of incoming power
 - c. Both a and b
 - d. None of the above
4. Transformers are based on:
 - a. Coulomb's law
 - b. Faraday's laws
 - c. Ohm's law
 - d. Kirchhoff's laws
5. Grid cutoff is mainly seen in:
 - a. Parallel grids
 - b. Focused grids
 - c. Stationary grids
 - d. Moving grids
6. The device **not** related to patient dose reduction is:
 - a. Intensifying screen
 - b. Filter
 - c. Grid
 - d. Collimator
7. The television camera used with fluoroscopy image intensifier is a:
 - a. Digital camera
 - b. Vidicon camera
 - c. Movie camera
 - d. Video camera
8. In a fluoroscopy image intensifier the image is carried from the input phosphor to output phosphor by:
 - a. Protons
 - b. Electrons
 - c. X-ray photons
 - d. Light photons
9. Image brightness in image intensifier is attributed to:
 - a. Minification gain
 - b. Flux gain
 - c. Both a and b
 - d. None of the above
10. In fluoroscopy imaging, the spot film is positioned between:
 - a. Image intensifier and TV camera
 - b. X-ray tube and patient
 - c. TV camera and television
 - d. Patient and image intensifier
11. A bar pattern test tool is used to find out:
 - a. Total filtration used in the x-ray machine
 - b. The size of focal spot
 - c. Mismatch between optical and radiation fields
 - d. Beam perpendicularity
12. Beryllium window is provided in x-ray tubes of:
 - a. Radiography
 - b. Fluoroscopy
 - c. Mammography
 - d. Dental radiography
13. Filament circuit uses:
 - a. High voltage
 - b. Low voltage
 - c. Medium voltage
 - d. No voltage
14. During x-ray production, what percentage of energy is converted into heat?
 - a. 1 %
 - b. 25 %
 - c. 50 %
 - d. 99 %

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Regn. No. DD.....

Paper Code: BRIT201

**B.Sc. MEDICAL TECHNOLOGY (RADIOGRAPHY AND IMAGING)
SECOND YEAR EXAMINATION, AUGUST - 2020
RADIOGRAPHIC PHOTOGRAPHY
PAPER - I**

[Time allotted: Two hours]

[Max Marks: 70]

Note: Attempt all questions

Draw suitable diagram wherever necessary

A : Short answer questions:

(06 x 10 = 60)

- Q. 1.** Discuss the formation of latent image on radiographic film.
- Q. 2.** What are different layers contained in a radiography film? Write the function of each.
- Q. 3.** Enumerate various precautions used to handle films in darkroom.
- Q. 4.** Define optical density. Discuss its relation with radiation exposure.
- Q. 5.** What is H & D curve? What are its different features?
- Q. 6.** Why intensifying screens are used? Define intensification factor.

B.Sc. MEDICAL TECHNOLOGY (RADIOGRAPHY AND IMAGING)
SECOND YEAR EXAMINATION, AUGUST - 2020
RADIOGRAPHIC PHOTOGRAPHY
PAPER - I
(MCQ)

Time allotted for MCQ - 15 minutes

B : MCQs (Single response type):

(01 x 10 = 10)

Select the most appropriate answer and **encircle** the alphabet against it

1. The light sensitive layer in radiography film is:
 - a. Emulsion
 - b. Base
 - c. Super coat
 - d. None of the above
2. Mammography films are:
 - a. Single coated
 - b. Double coated
 - c. May be both types
 - d. Uncoated
3. Radiographic films are double coated to increase:
 - a. Contrast
 - b. Sharpness
 - c. Resolution
 - d. Latitude
4. Characteristic curve of radiography film is:
 - a. U-shaped
 - b. V-shaped
 - c. S-shaped
 - d. C-shaped
5. Range of exposure to obtain useful densities of the film is known as:
 - a. Film gamma
 - b. Speed
 - c. Latitude
 - d. None of these
6. Which one of the following is not inferred from H & D curve?
 - a. Contrast
 - b. Speed
 - c. Latitude
 - d. Noise
7. Intensifying screen is based on the principle of:
 - a. Oxidation
 - b. Reduction
 - c. Photosynthesis
 - d. Luminescence
8. Film fog is due to:
 - a. Scattered radiation
 - b. Improper processing
 - c. Both a and b
 - d. None of these
9. Improper film-screen contact reduces:
 - a. Contrast
 - b. Resolution
 - c. Sharpness
 - d. Speed
10. Which process is acidic in nature?
 - a. Development
 - b. Replenishment
 - c. Fixation
 - d. None of these

**B.Sc. MEDICAL TECHNOLOGY (RADIOGRAPHY & IMAGING)
SECOND YEAR EXAMINATION, AUGUST - 2020
MEDICAL PHYSICS & EQUIPMENTS
PAPER - II**

[Time allotted: Two hours]

[Max Marks: 70]

Note: Attempt all questions.

Draw suitable diagrams wherever necessary.

A : Short answer questions:

(01 x 10 = 60)

- Q. 1.** Draw a neat diagram of radiography X-ray tube and show its various parts.
- Q. 2.** What is line focus principle and why it is used?
- Q. 3.** What is self-rectification of X-ray tube? Why are rectifiers used in X-ray generator circuit?
- Q. 4.** Discuss the means to prevent scattered radiation in radiography.
- Q. 5.** What is the principle of working of transformer? Mention different types of transformers.
- Q. 6.** What is fluoroscopic imaging? Discuss the role of image intensifier in it.

B.Sc. MEDICAL TECHNOLOGY (RADIOGRAPHY & IMAGING)
SECOND YEAR EXAMINATION, AUGUST - 2020
MEDICAL PHYSICS & EQUIPMENTS
PAPER - II
(MCQ)

Time allotted for MCQ - 15 minutes

(01 x 10 = 10)

B : MCQs (Single response type):

Select the most appropriate answer and **encircle** the alphabet against it

1. Filament circuit uses:
 - a. High voltage
 - b. Low voltage
 - c. Medium voltage
 - d. No voltage
2. During X-ray production, what percentage of energy is converted into heat?
 - a. 1%
 - b. 25%
 - c. 50%
 - d. 99%
3. Beryllium widow is used in:
 - a. Radiography tubes
 - b. CT tubes
 - c. Portable x-ray tubes
 - d. Mammography tubes
4. X-ray circuit employs:
 - a. Step-up transformer
 - b. Step-down transformer
 - c. Auto-transformer
 - d. All of the above
5. Which one of the following generator gives lowest ripple?
 - a. Half wave rectified
 - b. Full wave rectified
 - c. Three phase
 - d. Constant potential
6. Which one of the following is most suitable for beam shaping?
 - a. Aperture diaphragm
 - b. Cone
 - c. Cylinder
 - d. Collimator
7. Which type of grid is commonly used in diagnostic radiography?
 - a. Focused
 - b. Crossed
 - c. Parallel
 - d. None of the above
8. "Brightness gain" is related to:
 - a. Darkroom safe light
 - b. View box
 - c. Radiography film
 - d. Image intensifier
9. A grid is more efficient if it has:
 - a. High grid ratio
 - b. Low grid ratio
 - c. Medium grid ratio
 - d. None of the above
10. Use of grid:
 - a. Increases patient dose
 - b. Reduces scattered radiation
 - c. Improves image contrast
 - d. All of the above

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Regn. No. DD.....

Paper Code: BRIT203

**B.Sc. MEDICAL TECHNOLOGY (RADIOGRAPHY & IMAGING)
SECOND YEAR EXAMINATION, AUGUST - 2020
RADIOGRAPHY - I
PAPER - III**

[Time allotted: Two hours]

[Max Marks: 70]

Note: Attempt all questions

Draw suitable diagrams wherever necessary

A : Short answer questions:

(06 x 10 = 60)

- Q. 1.** What are the terms used for movement?
- Q. 2.** Define the anatomical planes and draw the related diagram.
- Q. 3.** What are the special terms for limbs positioning?
- Q. 4.** What are the functions of bones?
- Q. 5.** Write the classification of bones.
- Q. 6.** Write the nerve supply of the bones.

B.Sc. MEDICAL TECHNOLOGY (RADIOGRAPHY & IMAGING)
SECOND YEAR EXAMINATION, AUGUST - 2020
RADIOGRAPHY - I
PAPER - III
(MCQ)

Time allotted for MCQ - 15 minutes

B : MCQs (Single response type):

(01 x 10 = 10)

Select the most appropriate answer and **encircle** the alphabet against it

1. The largest of the tarsal bone is termed as:
 - a. Talus
 - b. Calcaneus
 - c. Cuboid
 - d. Navicular
2. The focus film distance in the x-ray of heart and aorta is:
 - a. 120cm
 - b. 100cm
 - c. 150cm
 - d. 180cm
3. Subtalar joint is between the:
 - a. Tibia and fibula
 - b. Talus and fibula
 - c. Talus and calcaneus
 - d. Talus and tibia
4. The line from the lowest point on inferior orbital margin to upper border of external auditory meatus is called:
 - a. Auricular line
 - b. Inter-orbital line
 - c. OMB line
 - d. Anthropological base line
5. Bones on each hand and wrist are:
 - a. 26
 - b. 27
 - c. 28
 - d. 25
6. Cone view is specially used in the following X-ray **except**:
 - a. Spine
 - b. Optic foramina
 - c. Mastoid
 - d. KUB
7. MP joints and CM joints are used to describe the:
 - a. Hand
 - b. Face
 - c. Head
 - d. Hip
8. Single hip lateral x-ray is taken by rotating the patient:
 - a. 25° to the site being examined
 - b. 25° anteriorly
 - c. 45° to the site being examined
 - d. 25° posteriorly
9. In AO view of sternum, the patient is rotated to:
 - a. 10°
 - b. 20°-30° either side
 - c. 20° left
 - d. 15° right
10. X-ray projection knee intercondylar fossa is taken in:
 - a. PA
 - b. AP
 - c. Tunnel
 - d. Oblique