D 91536 **(Pages : 2)** **Name**.....

Reg. No.....

THIRD SEMESTER P.G. DEGREE EXAMINATION, NOVEMBER 2020

(CCSS)

M.Sc. Radiation Physics

RPH 3C 17—RADIATION HAZARDS, SAFETY, EVALUATION AND CONTROL

(2019 Admissions)

Time : Three Hours Maximum : 70 Marks

Section A

Answer any **six** *questions.*
Each questions carries 3 *marks.*

1. Explain the methods of achieving ALARA principle in diagnostic radiology ?
2. What are the ICRP 60 recommendations for radiation workers ?
3. Discuss briefly about lead apron integrity test ?
4. Explain decontamination procedure in nuclear medicine department ?
5. Draw and label the delay tank system for high dose therapy ?
6. Explain the radioactive waste management in a nuclear medicine department ?
7. Mention the responsibilities of a radiological safety officer ?
8. Explain the survey meters using for 6MV linac and HDR brachytherapy room and justify your answer ?
9. Define the work load of a X-ray machine ?

(6 × 3 = 18 marks)

Section B

Answer **all** *questions.*
Each questions carries 14 *marks.*

10. a) Explain the wall thickness calculation and room layout preparation of HDR brachytherapy unit using lr-192 source ?

Or

b) Discuss about the room layout and planning of a PET CT unit ?

Turn over

11. a) Explain the planning of a radiology department ?

Or

b) Explain the planning of a nuclear medicine department ?

(2 × 14 = 28 marks)

Section C

Answer any **four** *questions.*
Each question carries 6 *marks.*

12. What is the thickness of lead that reduces the exposure to 0.1 R/wk for a person at a distance of 1m from a 100 mg radium source encapsulated with 0.5 mm Pt (lr) for 40 hr/wk ? The exposure rate constant T_∞ is 0.825(R-m2)/ (hr-Ci) for radium filtered by 0.5 mm Pt (lr).

13. Calculate the work load of a diagnostic X ray department, with 20 patients/day, 3 films per patient and 50 mAs per film ?

14. A diagnostic x-ray generator has a busy work load of 1000 mA-min/wk at 100 kVp. The x-ray tube is positioned 4.5 m from a wall between the radiation room and a radiologist's office. The wall contains 3 cm of ordinary concrete. For a use factor of 0.5, what is the thickness of lead that must be added to the wall ?

15. A patient receives 2 minutes of fluoroscopy (80 kVp, 3 mA) and four spot films (80 kVp, 30 mA-s) over the, 20-cm thick lower abdominal region. The x-ray tube to-tabletop distance is 0.5 m for the x-ray unit used for the examination. A short time later it is determined that the patient was 3 weeks pregnant at the time of the examination. Estimate the dose to the fetus.

16. A radioactive material decays to 40% in one hour. What is the half life of the material ?

17. The exposure level at a particular-distance from the radioactive source shielded with 2TVT + 2HVT is 100 mR/hr, What will be the radiation level if the shielding is removed ?

(4 × 6 = 24 marks)

D 91537 **(Pages : 2)** **Name**.....

Reg. No.....

THIRD SEMESTER P.G. DEGREE EXAMINATION, NOVEMBER 2020

(CCSS)

M.Sc. Radiation Physics

RPH 3C 18—PHYSICS OF MEDICAL IMAGING

(2019 Admissions)

Time : Three Hours Maximum : 70 Marks

Section A

Answer any **six** *questions.*
Each question carries 3 *marks.*

1. Explain the process of interaction of electron with the x-ray target atom.
2. Briefly discuss the physics of latent image formation.
3. Discuss the action of developer in-the film processing.
4. Explain detectors using in CT.
5. Mention different modes of ultrasound scan.
6. Explain the working of an ultrasound transducer.
7. Define T1 and T2 relaxation time.
8. Explain the bio effects of MRI.
9. Define acoustic impedance.

(6 × 3 = 18 marks)

Section B

Answer **all** *questions.*
Each question carries 14 *marks.*

10. a) Explain single phase x-ray generator with proper diagram.

Or

b) Discuss about the different steps involved in a manual film processing.

11. a) Explain any one of the image reconstruction method using in CT.

Or

b) Discuss different coil systems using in MRI.

(2 × 14 = 28 marks)

Section C

Answer any **four** *questions.*
Each question carries 6 *marks.*

12. A region of processed film transmits 10% (T = 0.1) of the incident light. What is the optical density of the region ?

13. The Intensity of 3 MHz ultrasound beam entering tissue is 10mW/cm^2. Calculate the intensity at depth of 4.cm ?

14. What is the angle of refraction for an ultrasound beam incident at an angle of 15 degrees from muscle into bone ?

15. The target slopes at an angle of 12 degrees in a diagnostic x-ray tube. Electrons are focused along a strip of the target 2 mm wide. How long is-the strip if the apparent focal spot is 2 × 2 mm ?

16. Calculate the maximum photon frequency and minimum wavelength of x-ray produced from a diagnostic tube operating at 120 kVp ?

17. If a dose of 0.05 Gy (5 cGy) is delivered uniformly to the uterus during a diagnostic x-ray examination, how much energy is absorbed by each gram of the uterus ?

(4 × 6 = 24 marks)

D 91538 (Pages : 2) Name.....

Reg. No.....

THIRD SEMESTER P.G. DEGREE EXAMINATION NOVEMBER 2020

(CCSS)

M.Sc. Radiation Physics

RPH 3C 19—PHYSICS OF RADIOTHERAPY

(2019 Admissions)

Time : Three Hours Maximum : 70 Marks

Section A

Answer any **six** *questions.*
Each question carries 3 *marks.*

1. "Water is as an ideal phantom for radiotherapy measurements"—Justify this comment ?
2. Compare the PDD curves of 250KVp x-ray, Co-60, 6 and 10 MV photons ?
3. Define mayneord factor ?
4. Write a note on cerobend ?
5. What are the characteristics of an ideal brachytherapy source ?
6. Define flatness and symmetry of a 15 MV photon beam ?
7. Write a short note on photon field matching ?
8. Explain the laser systems using in radiotherapy ?
9. Define equivalent square field- ?

(6 × 3 = 18 marks)

Section B

Answer **all** *questions.*
Each question carries 14 *marks.*

10. a) Explain tele cobalt machine with proper diagram ?

Or

b) What are the different shutter mechanisms used in tele cobalt machine ?

Turn over

11. a) Explain different dosimetric parameter of radiotherapy ?

Or

b) What is meant by beam modifying device and explain different types of beam modifying devices ?

(2 × 14 = 28 marks)

Section C

Answer any **four** *questions.*
Each question carries 6 marks.

12. The exposure level at a particular distance from the radioactive source shielded with 2TVT + 2HVT is 100 mR/hr. What will be the radiation level if the shielding is removed ? Calculate the PDD for a depth of 10 cm for a 60Co beam which is 10 × 10 cm^2 at patient surface and 130 cm SSD ?

13. Calculate the Monitor Units Necessary to deliver a dose of 200 cGy to a depth of 8 cm from parallel opposed fields equally weighted. The field size is 15 × 15 blocked to an 8 × 8 field. The patient has to be treated with an extended distance of 120 cm SSD. Assume that the field size given is defined at 120 cm. The energy that is used is 6 MV. (Given : Sc for 12.5 = 1.023, Sp for 8 cm field = 0.993, PDD for 8 × 8 field = .732)?

14. A cylindrical body section has a diameter of 20 cm and length of 15 cm. The density of tissue is 1.0 g cm^{-3} ; In a treatment plan adopted for irradiation, the average dose to the volume is assessed to be 1200 cGy. Calculate the integral dose ?

15. A patient is treated with parallel-opposed mantle and para-aortic fields of lengths 30 and 15 cm, respectively. Calculate (a) The gap required on the surface for the beams to intersect at a midline depth of 10 cm ? (b) The gap required to just eliminate the three-field overlap on the cord assumed to be at a depth of 15 cm from the anterior surface, given SSD = 100 cm for all the fields ?

16. Given that the HVL in pb of cobalt radiation is 11 mm, Calculate the thickness of lead required to compensate the dose at a point at a depth of 6 cm below an air gap of 2.5 cm in a 10 × 10 cm beam ?

17. A 10 mg radium source is inadvertently left in an unshielded drawer for 7 hours. Estimate the exposure that would be received by a worker who remained at a distance of 20 cm from the source for this time ?

(4 × 6 = 24 marks)

D 91539 **(Pages : 2)** **Name.....**

Reg. No.....

THIRD SEMESTER P.G. DEGREE EXAMINATION, NOVEMBER 2020

(CCSS)

M.Sc. Radiation Physics

RPH 3C 20—NUCLEAR MEDICINE

(2019 Admissions)

Time : Three Hours Maximum : 70 Marks

Section A

Answer any **six** *questions.*
Each question carries 3 *marks.*

1. What is mean by effective half life ?
2. Explain the fume hood using in idodine-131 hot lab.
3. What are the different scintillation crystals using in a PET CT ?
4. Explain the working principles of an isotope calibrator.
5. What are the characteristics of radiopharmaceuticals ?
6. Explain technetium generator.
7. Write any five radiopharmaceuticals and their clinical study.
8. Discuss about Iodine-131.
9. Draw a normal Gaussian probability distribution curve.

(6 × 3 = 18 marks)

Section B

Answer **all** *questions.*
Each question carries 14 *marks.*

10. a) Explain gamma camera with proper diagram.

Or

b) Write collimator system using in gamma camera.

11. a) Explain different radioactive waste management system following in nuclear medicine.

Or

b) Write details about PET CT system.

(2 × 14 = 28 marks)

Turn over

Section C

Answer any **four** *questions.*
Each question carries 6 *marks.*

12. Calculate the radiation dose to the liver (LI) to an average adult male for an injection of 100 MBq of 99m Tc sulphur colloid. Assume that 60% of the activity is trapped by the liver, 30% by spleen (SP), and 10% by red bone marrow (RM), with instantaneous uptake and no biologic excretion ?

13. Xe 133 a radioactive inert gas is used for lung function studies. Its physical half life is 5.3 days and its biological half life is about 0.35 minutes. Determine the effective half life of Xel33 in lungs?

14. A preparation of Tc99m was calibrated at 7 am and contained 555MBq/ml (15mCi/ml) of radioactivity at that time. If the prescribed dosage to the patient is 555 MBq (15 mCi) determine the volume of preparation that will have to be injected at 10 a.m ?

15. Suppose that 100 MBq of a 99m Tc labelled microspheres are injected in to a patient, with essentially instantaneous uptake of activity by lungs. What is the cumulated activity in the lungs if 60% of the activity is excreted from lungs with biologic half life of 15 minutes and 40% with half life of 30 minutes ?

16. What will be the activity of an 800 Cl ^{60}Co source after 5 years ? Also find the specific activity of the source after 5 years ?

17. In a thyroid uptake measurement on a patient, is has found that the neck activity gives 800 counts per minutes where as the standard is 2500 counts per minute. Calculate the % of uptake by the thyroid ?

(4 × 6 = 24 marks)