**QP Code:** **Reg. No.....**

# Post M.Sc Diploma in Radiological Physics Examination
## (Model Question Paper)

## Paper V: Radiation Dosimetry and Standardisation

**Time: 3 hours** **Maximum Marks: 100**

- Answer all questions
- Use of Calculators/physical and mathematical tables permitted.

**Essays** **[2 x 14 = 28]**

**1.** Describe briefly the principle of Na I (Tl) scintillation detector. Draw the pulse height spectrum of Cs-137 gamma rays using Na I (Tl) detector and describe the features of the spectrum.

A beam of 660 KeV gamma photons is normally incident on a Na I (Tl) detector of thickness 4cm. What is the intrinsic efficiency of the detector. ($\mu$ = 0.78 $cm^{-1}$)

**[9 + 5 = 14]**

**2.** Explain the formation of the depletion region in a semiconductor. How this is used as a radiation detector.

What is the voltage change produced in an air filled ion chamber of capacitance 150 pF when a 120KeV beta loses its energy in the sensitive volume of the chamber.

**[9 + 5 = 14]**

**Short Essays** **[4 x 8 = 32]**

3. Standard and field dosimeters
4. Expression for specific gamma ray constant
5. Gamma zone monitor
6. Secondary standard dosimeter

**Short Notes** **[10 x 4 = 40]**

7. Rectal dosimeter
8. Contamination monitor
9. Exposure
10. Dose
11. Kerma
12. Dose ï equivalent
13. Thermoluminescent dosimeter.
14. Current type and pulse type ionisation chambers
15. Extrapolation chamber
16. BF3 Counter

**QP Code:** **Reg. No.....**

# Post M.Sc Diploma in Radiological Physics Examination
## (Model Question Paper)

### Paper VI: Radiation Detectors and Instrumentation

Time: 3 hours Maximum Marks: 100

- **Answer all questions**
- **Use of Calculators/physical and mathematical tables permitted.**

**Essays** **[2x 14 = 28]**

**1.** Describe the working of a graphite calorimeter with the help of a block diagram and circuit diagram. Compare the graphite calorimeter with a water calorimeter and state the advantages and disadvantages if any.

A cylindrical air wall chamber of radius 0.6cm with a central electrode of radius0.06cm is used to measure continuous radiation from a cobalt unit with an exposure rate of 3000R/min with a collection voltage of 200V. Find the efficiency of ion collection. Assume kcyl = 1.19 **[9 + 5 = 14]**

**2.** Describe the quenching process in a GM tube and briefly give various methods used for quenching the gas.

In an experiment to calculate the resolving time, a GM counter gave 1204sounts/s for source A, 1262counts/s for source B and 2162 counts/s for sources A and B together. What is the resolving time of the GM counter neglecting the background. **[9 + 5 = 14]**

**Short Essays** **[ 4 x 8 = 32 ]**

3. Explain requirements of insulators in ion chambers**.**
4. Describe briefly neutron detection by induced activity.
5. Describe the features of a scintillation spectrometer.
6. Townsend balance secondary standard dosimeter

**Short Notes** **[ 10 x 4 = 40 ]**

7. Solid state nuclear track detector (SSNTD)
8. Film badge
9. Pocket dosimeter
10. G M counter
11. Plastic scintillator
12. Area monitor
13. TLD reader
14. Optically stimulated luminescence dosimeter
15. Radiation field analyser
16. Whole body counter

**QP Code:** **Reg. No.....**

# Post M.Sc Diploma in Radiological Physics Examination

## (Model Question Paper)

## Paper VII: Radiation Therapy

Time: 3 hours Maximum Marks: 100

- **Answer all questions**
- **Use of Calculators/physical and mathematical tables permitted.**

**Essays** **[2 x 14 = 28]**

1. What is Percentage Depth Dose. What are the factors that influence PDD.

   Three 6 x 10cm$^2$ Co-60 fields (SAD=80cm) are directed at 120$^0$ to each other, such that they intersect at a point which is at a depth of 10cm, 12cm and 15cm respectively from the entrance surface of the three fields. If the dose rate in free space at 80cm for the given field size is 120cGy/min and the dose given at the intersection point is 300cGy/day, calculate the total treatment time if tumour dose by each field is same. **[9 + 5 = 14]**

2. Explain the Manchester System for treating cancer of the uterine cervix.

   Describe the quality assurance checks to be carried out in remote afterloading brachytherapy. **[9 + 5 = 14]**

**Short Essays** **[ 4 x 8 = 32]**

3. Simulation in radiotherapy
4. MLC and portal imaging.
5. Characteristics of a clinical electron beam and its uses
6. Beam modifying devices

**Short Notes** **[10 x 4 = 40]**

7. Beam flatness
8. Beta ray applicator
9. Penumbra
10. Integral dose
11. Patterson parker dosage system for planar mould application
12. Radium and substitutes
13. SRS/SRT
14. Wedge filters
15. Monte Carlo for photon beam
16. Total body irradiation

**QP Code:** **Reg. No.....**

# Post M.Sc Diploma in Radiological Physics Examination

## (Model Question Paper)

## Paper VIII: Radiation Safety

Time: 3 hours Maximum Marks: 100

- **Answer all questions**
- **Use of Calculators/physical and mathematical tables permitted.**

**Essays** **[2 x 14 = 28]**

1. Explain justification of practice and ALARA.

   A person receives an annual whole body dose of 0.02mGy of X-rays, 0.01mGy of neutrons of energy 5 keV and 0.1mGy of gamma rays. Calculate the equivalent dose received by the person in a year. Given: $W_r$ for neutrons of energy 5keV = 5. **[ 9 + 5 = 14]**

2. What are the responsibilities of a Radiological Safety Officer as mentioned in RPR 2014.

   What is the dose rate at 2 m from a 7.4GBq point source of Cs-137. What is the thickness of Lead required to reduce the dose rate to less than 0.02mGy/h. If the source activity is increased to 29.6GBq, what additional thickness of Lead would be required to keep the dose rate at the same level. Given: HVL of Lead: 7mm. Dose Rate Constant of Cs-137 : 8.5 x $10^{-8}$ Gy-$m^2$/MBq-h. **[ 9 + 5 =14]**

**Short Essays** **[4 x 8 = 32]**

3. The effects of whole body acute exposure of human beings to 4 Gy
4. Early effect and late effect;
5. Factors that influence the process of radiation carcinogenesis
6. Dominant and recessive genetic disorder

**Short Notes** **[10 x 4 = 40 ]**

7. The materials used for neutron shielding
8. Radiation accidents
9. Precautions for I-131 administration for therapy of thyroid cancer
10. Natural background radiation
11. Radiation weighting factor
12. Tissue weighting factor
13. Stochastic effect
14. Genetic and somatic effect
15. Annual dose limits
16. Disposal of radioactive waste