

**THE ROYAL AUSTRALIAN AND NEW ZEALAND COLLEGE OF
RADIOLOGISTS**

EXAMINATION FOR DIPLOMA, PART I

RADIATION ONCOLOGY
RADIOTHERAPEUTIC PHYSICS

Time allowed: 3 hours

ALL QUESTIONS are to be attempted. All questions are of equal value.
Clearly labeled diagrams should be drawn wherever relevant.

1. Give the principles underlying the recommendations of the International Commission on Radiological Protection. Describe how these are incorporated into national standards and into regulatory frameworks in Australasia. Give the current effective dose limits.
2. Discuss the principles of the use of unsealed radionuclides in radiation oncology. Describe the concepts of uptake, distribution and elimination. Indicate the activities used in clinical practice and how the dose to target tissues and critical organs is estimated.
3.
 - a) Sketch on the same graph central axis depth dose curves for the following photon beams, incident vertically on a water phantom:
 - 6MV, 100cm SSD, 10 x 10 and 20 x 20cm field sizes,
 - 250kVpeak, 3mm Cu HVL, 50cm SSD, 10 x 10 and 20 x 20 cm field sizes.
 - b) Explain with reference to the underlying physics the important features of these curves and discuss the clinical significance of these features. (c) Discuss other clinically relevant differences between megavoltage and kilovoltage photon beams.
4.
 - a) Discuss the physical properties of Caesium- 137 with regard to its suitability as a radionuclide for brachytherapy.
 - b) Describe the construction of sources containing Caesium- 137, designed for brachytherapy of cancer of the uterine cervix, for use with:
 - a manual afterloading system,
 - a remote afterloading system employing pneumatic source propulsion.
 - c) Define points A and B in the Manchester system of brachytherapy of cancer of the uterine cervix and explain their significance.
 - d) List the ICRU recommendations on dose and volume specifications for reporting brachytherapy treatments of cancer of the uterine cervix.
5. Discuss the physical aspects of
 - a) Electronic Portal Imaging.
 - b) Stereotactic radiotherapy.
6. Discuss the following:
 - a) Field junctions between (i) adjoining electron beams (ii) an electron beam adjoining a photon beam.
 - b) Effects of tissue inhomogeneity on electron beams including lung, bone and air filled cavities.
 - (c) Internal shielding with electron beams.

August 1997.