February 1999

1. Clearly describe how the high speed stream of electrons which have been generated in the waveguide of a linear accelerator may then be manipulated and controlled in order to produce beams of:
   (a) photons and
   (b) electrons for clinical use.
   Describe how the doses in these beams may be monitored and give the energy ranges and various beam parameters attainable.

2. Discuss the concepts of and give definitions of the units of kerma, absorbed dose, dose equivalent, effective dose, linear energy transfer, stopping power, integral dose, activity and specific activity.

3.
   (a) Briefly outline the principles of the procedure for the absolute calibration of a megavoltage beam (i.e., the determination of the dose per monitor unit (m.u.) under reference conditions) in a radiotherapy department.
   (b) Comment on the choice of phantom material and type of radiation detector used for this calibration.
   (c) What factors need to be taken into account in the calculation of the number of m.u. required to deliver a particular dose from a given megavoltage beam to a particular point on the axis of that beam within a patient?
   (d) Explain how the number of m.u. which a linear accelerator delivers in an irradiation is controlled.

4. Describe and explain how the dose distribution produced within a patient by an x-ray beam is modified by the presence of
   (a) bone and
   (b) lung within the beam, for beams of various energies.
   Include consideration of the doses to the bone and to the lung themselves.

5. Write short notes on:
   (a) ICRU dose specification for gynaecological brachytherapy.
   (b) Usage of the Paris system in interstitial brachytherapy.

6. Write short notes on:
   (a) Potential errors and uncertainties which may arise in the incorporation of CT and MRI images into radiation therapy planning systems. How might these errors and uncertainties be minimised or avoided?
   (b) ICRP dose limits for occupational and public exposure.