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1. Describe and discuss the various processes which may occur when a beam of ionizing radiation interacts with biological matter of varying density. Distinguish between electron and X-ray beam interactions.
2. Discuss natural and artificial radioactivity. Describe the common decay processes. Define and discuss physical, biological and effective half-lives and the relationships between them. Give an example of these relationships for a radionuclide that is commonly used in radiotherapy.
3. Discuss the principles, implementation, applicability, advantages and disadvantages of the following techniques in megavoltage photon beam radiotherapy:
 - (a) multiple static fields
 - (b) rotation therapy
 - (c) conformal (conformation) therapy.
4. Explain how and why the dose distribution produced within a patient by an X-ray beam is modified by the presence of
 - (a) lung and
 - (b) bonewithin the beam for beams of various energies. Include consideration of doses to the lung and bone constituents themselves.
5. Discuss the quality assurance measures necessary in
 - (a) the planning and treatment delivery of stereotactic radiosurgery for intracranial lesions
 - (b) pulse dose rate brachytherapy for cervical carcinoma.
6.
 - (a) Define the following terms as used by the ICRU:
 - i. Clinical Target Volume
 - ii. Internal Margin
 - iii. Set-up Margin
 - iv. Planning Target Volume (PTV)
 - v. Conformity Index
 - vi. Internal Target Volume.
 - (b) Define the penumbra of the beam. Is the penumbra considered in delineating the PTV?
 - (c) Give typical values used for Set-up Margin and Internal Margin in curative conformal external beam radiotherapy of
 - i. carcinoma of the prostate
 - ii. carcinoma of the lung apex abutting the spinal canal.