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MPS 554

Fourth Semester M.Sc. Degree Examination, Sept./Oct. 2022
MEDICAL PHYSICS
Nuclear Reactors, Particle Accelerators, Industrial Applications of
Radiation and Environmental Radioactivity

Time : 3 Hours

Max. Marks : 70

Instructions : 1) Number the answers **properly**.
2) Answer **all** questions.
3) Give illustrations **wherever** necessary.

PART – I

Answer **any five** of the following :

(5×4=20)

1. Discuss the production of ions in particle accelerators.
2. Explain the working principle of Cyclotron.
3. Calculate the consumption rate of Uranium-235 (in kg/second) in a nuclear reactor operating at a power of 100 MW (thermal). Given : the energy content of Uranium-235 is 8.20×10^{13} J/kg.
4. Discuss about the cosmogenic origin of radionuclides in the environment.
5. Write a note on impact of atmospheric nuclear weapon testing on marine and terrestrial environments.
6. What is TA-GVHD ? Write a note on gamma irradiation for blood and its importance.

PART – II

Answer **any five** of the following :

(5×10=50)

7. What do you mean by a critical mass of a fissile nuclide ? Define the neutron multiplication factor. What are the values of multiplication factors for the critical, subcritical and supercritical state ? Define the four-factor formula and explain the terms. Discuss the neutron energy suitable for fission reaction.

OR

Discuss different types of research reactors and its applications. How research reactors are different from power reactors ? Which are the important medical radioactive sources produced in research reactors ?

P.T.O.



8. Explain in detail, along with neatly drawn diagrams, about any two types of oscillating beam accelerator.

OR

Explain in detail about the working principles of Van de Graff generators and LINAC.

9. Explain on the use of radiation/radioisotopes in (a) identifying void in the metal block, (b) level monitoring and (c) detection of blockages and leakage in pipelines.

OR

Discuss the applications of radiation in food processing and typical radiation dose used for these applications. Discuss the advantages of food processing using nuclear radiations.

10. Discuss the sources of radon and thoron in the environment. Elaborate on various passive and active technique for their measurements.

OR

Write a note on technologically enhanced natural radioactivity in the environment. Discuss the sources of man-made radionuclides in the earth.

11. Discuss the polymer conversation processes under the influence of electron beam or gamma radiation with one example of each process.

OR

Explain in detail about the nuclear fuel cycle.
