D3APH2004 (2 Pages) **Name.....**
Reg.No.....

THIRD SEMESTER M.Sc. DEGREE EXAMINATION, NOVEMBER 2021
(Regular/Improvement/Supplementary)

PHYSICS
FPHY3E03: RADIATION PHYSICS

Time: Three Hours **Maximum Weightage: 30**

Part A: Short answer questions. *All* questions can be answered. Each carries *one* weightage. (Ceiling 6 weightage).

1. What is Linear Energy Transfer? How is it related to stopping power?
2. What is meant by biological effectiveness? Mention its importance.
3. What is tissue wighting factor?. What is its importance in radiology?
4. What is the application of Radiation survey meter? Which type of detector is used for this purpose?
5. What is stochastic effect? Give one example. What are its characteristics?
6. What is the basic principle of radiation protection?
7. What is the importance of shielding in radiation protection?
8. What is the shielding criterion for safe transport of radioactive sources?

Part B: Essay questions. *All* questions can be answered. Each carries *six* weightage. (Ceiling 12 weightage).

9. Discuss the basic principle of artificial production of isotope. What are the most common methods used for accelerated based production and reactor based production? How will you optimize the production in each case?
10. Discuss the energy loss mechanism of heavy charged particles in matter. Explain the significance of the following terms in the process: Stopping power, straggling and Bragg curve.
11. Explain the characteristics of a good radiation detector. Discuss the functioning of TLD badges. Explain how the mechanism of recording the dose and how are they read.
12. Discuss basic principle of radiation safety. Explain how this is achieved. Discuss the shielding conditions for beta, gamma, neutron and charged particles like proton and alpha.

(P.T.O.)

Part C: Problems. *All* questions can be answered. Each carries *four* weightage. (Ceiling 12 weightage).

13. A reactor produces 10^8 neutron flux at the targeted area. Calculate the duration of exposure of 1 mg/cm^2 thick Cu-65 foil of 1 cm^2 size to get a yield of 10,000 particles. Assume Cross section for (n,2n) reaction is 10 mb at thermal energies.

14. The mass attenuation coeffecient of 667 keV gamma ray in aluminium is 0.075 cm^2/g. Calculate the thickness of the half value thicknes, 10^{th} value tickness of the foil. Calculate it for lead.

15. The stopping power for 4 MeV proton in aluminium is 67 MeV-cm^2/g. Calculate the energy loss on traversing one micron of Alumnium. Calculate the same for alpha particle of same energy. Use standard density of aluminium.

16. What is the rate of disintegration of 1 curie source of Co-60? Calculate the gamma flux at 1 meter away from the source.

17. Write down the radiolysis of water showing the production of various ions and radicals.

18. If tissue density is treated as equivalent to water, calculate the absorbed dose of 1 MeV photon of intensity 10^6 is falling on a tissue of 1 cm^2 in area and 5 mm thickness. Mass attenuation coefficient is 0.07 cm^2/g

19. If the dose rate at 5 cm from a small-sized radioactive source is 1 S_v/h (100 rem/h), estimate the dose rate at 20 cm.