D3APH2204 **(2 Pages)** **Name.....**
Reg.No.....

THIRD SEMESTER M. Sc. DEGREE EXAMINATION, NOVEMBER 2023
(Regular/Improvement/Supplementary)

PHYSICS
FPHY3E03: RADIATION PHYSICS

Time: 3 Hours **Maximum Weightage: 30**

Part A: Short answer questions. Answer *all* questions. Each carries *one* weightage.

1. What is artificial isotope? How is it different from natural isotopes? Give examples.
2. Briefly explain the sources of any two radiations.
3. What are energy straggling and range straggling? Mention the importance of these.
4. Differentiate between flux, fluence and intensity of radiations.
5. What is effective dose? How is it related to bilogical effectiveness?
6. What is stockastic effect? What is its relevance? What are the commonly noted stochastic effects?
7. What is radiolysis? What is its importance?
8. What is the principle of radiation thearpy? Explain the mechanism briefly.

(8 × 1 = 8 weightage)

Part B: Essay questions. Answer any *two* questions. Each carries *five* weightage.

9. Discuss the mechanism of energy loss by heavy charged particles. Obtain the equation for specific energy loss, stopping power and range of the particles.
10. Discuss various quantities of measurement of radiations and their units. Explain the importance of each measurement. What are the types of detectors used for each measurement?
11. Give a detailed interaction of radiation in molecular level and tissue level. Identify various stochastic and deterministic effects induced and their thresholds.
12. Explain how radioactive materials are classified. Explain the precautions, measurements and labelling to be adopted while transporting each category of radioactive materials.

(2 × 5 = 10 weightage)

(P.T.O.)

Part C: Problems. Answer any *four* questions. Each carries *three* weightage.

13. Calculate the maximum energies of a proton and an electrons coming out a cyclotron of radius 50 cm, working with a magnetic field of 1 Tesla.

14. A fission reactor is working on uranium fuel at a power of 1 MW. Calculate the amount of uranium 235 in gram. Average energy released per fission is 200 MeV.

15. 667 keV gamma ray from Cs-137 isotope undergo Compton scattering with Cu-target. Calculate the energy of gamma ray scattered at 90^{o}. What is the energy of electron?

16. Calculate the thickness of copper foil to stop 5 MeV alpha particle. What should be the fluence of alpha particles to deposit a total energy of 1 Joule. ($dE/dx = 45$ MeV/g.cm^2.)

17. Calculate the effective dose of 10 MeV neutron and 10 MeV alpha particles on skin, liver, gonads and breast. The absorbed dose is 20 mGray (the data given below may be used).

    [W_R, gamma =1, electron =1. proton = 2,neutron =10, alpha =20, W_T , skin, brain = 0.01, liver, bladeer, thyroid = 0.04, gonards =0.08, breast, stomach, lung =0.12]

18. Calculate the thickness of shielding material for safe storage of 1 Ci of Co-60 sample. Calculate the half value thickness and 10^{th} value thickness. Mean attenuation coefficient for the gamma rays in Lead is 5.87 x10^{-2} cm^2/g.

19. In the above index, calculate the transport index and type of labelling of the package.

(4 × 3 = 12 weightage)