B.Sc. 4th Semester (Honours) Examination 2020-21
PHYSICS

Course ID: 42415   **Course Code: SH/PHS/405/SEC-2**

Course Title: Radiation Safety (SEC T3)

Time: 2 Hours   **Full Marks: 40**

The figures in the margin indicate full marks.
Candidates are required to give their answers in their own words as far as practicable.

Section-I

1. Answer any *five* questions: 2 X 5=10

a) What is nuclear waste?

b) What is radiation sickness?

c) Define Annual Limit on Intake (ALI).

d) What do you mean by Derived Air Concentration (DAC)?

e) Mention different modes of β decay with suitable equations.

f) What is Cerenkov radiation?

g) What do you mean by the cross section of a nuclear reaction?

h) Why fusion is also known as thermo-nuclear reaction?

Section-II

2. Answer any *four* questions: 5X4=20

(a) Discuss the mechanisms through which γ ray photons interact with matters. What do you mean by linear and mass attenuation coefficients?   [3+(1+1)]

(b) What do you mean by the ionization of a medium? Explain the terms (i) Absorbed dose, (ii) Equivalent dose and (iii) Effective dose.   [2+(1+1+1)]

(c) Mention three different types of nuclear reactions with proper examples. What is the Q value of a nuclear reaction?   [3+2]

(d) What is nuclear binding energy? How does the average nuclear binding energy depend on nuclear mass number?   [2+3]

(e) What do you mean by KERMA? What is its unit? What is the relation of KERMA with absorbed dose?   [2+1+2]

P.T.O.

(f) Show that the numbers of atoms present in a particular radioactive substance decreases exponentially with time. What is half-life period of a radioactive substance? The half-life period of radium is 1590 years. In how many years one gram of pure element will be reduced to one centigram?   [2+1+2]

Section- III

3. Answer any *one* question: 10X1=10

(a) Why the X-rays are more penetrative than visible light? How the intensity and frequency of X-rays can be controlled during the production of X-rays? Mention the main features of continuous X-ray spectrum. Discuss the origin of characteristic X-rays with proper diagram. An X-ray tube with Cu target is operated at 28 kV. The smallest glancing angle for NaCl crystal for the CuK_α line is 15.8°. Find the wavelength of this line. Also find the glancing angle for photons at the short wavelength limit. (d_{NaCl} = 0.282 nm).   [1+2+2+3+(1+1)]

(b) Discuss the mechanisms of radiation damage of living cells. Mention the determinants of biological effects caused due to exposure of ionizing radiations. Explain Stochastic and Deterministic effects of ionizing radiations on living cells.   [4+2+(2+2)]

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