This question paper contains **4** printed pages]

Roll No. | | | | | | | | | | |

S. No. of Question Paper : **1836**

Unique Paper Code : **2173012010**

Name of the Paper : **DSE : Nuclear and Environmental Chemistry**

Name of the Course : **B.Sc. (Hons.) Chemistry**

Semester : **IV/VI**

Duration : **3 Hours** Maximum Marks : **90**

(Write your Roll No. on the top immediately on receipt of this question paper.)

Attempt *six* questions in all.

All questions carry equal marks.

1. (*a*) If an atom of $^{235}U_{92}$ undergoes nuclear fission reaction after absorbing a slow moving neutron, then $^{98}X_{40}$ and $^{136}Y_{52}$ are produced. What other particles are produced ?

(*b*) Calculate the binding energy per nucleon for an oxygen atom with atomic mass 15.994910 amu. (Given : neutron = 1.008665 amu, proton = 1.007277 amu, electron = 0.0005486 amu)

(*c*) Explain the working and principle of an ionization chamber. 5,5,5

P.T.O.

2. (*a*) What is artificial transmutation ? Give the nuclear reactions induced by neutron, proton and α-particles.

(*b*) Compare nuclear fission and nuclear fusion with examples.

(*c*) Draw and describe the binding energy per nucleon *vs.* mass number curve. What does its shape indicate about nuclear stability ? 5,5,5

3. (*a*) Explain the construction and working principle of a fast breeder nuclear reactors.

(*b*) Explain the following to describe the structure and stability of the nucleus :

(*i*) Meson theory

(*ii*) Liquid Drop Model

(*c*) Derive a relation between half-life and decay constant. What is the order of a radioactive disintegration process ? 5,5,5

4. (*a*) Explain the formation of ozone in the stratosphere through photochemical reactions. Discuss the role of chlorofluorocarbons (CFCs) behind ozone depletion.

(*b*) What are SPMs ? How do they cause harm to human beings ? What is the significance of PM2.5 and PM10 in air quality monitoring ?

(*c*) Compare and contrast the environmental impacts of CO, NOx and SOx. Describe methods used to estimate the concentration of any *one* of these air pollutants. 5,5,5

5. (*a*) What is the mechanism of PAN formation in photochemical smog ?

(*b*) Evaluate the working principle and efficiency any *two* of the following air pollution control devices :

(*i*) Settling Chamber

(*ii*) Venturi Scrubber

(*iii*) Electrostatic Precipitator (ESP)

(*c*) What are air pollutants ? Describe the major types of air pollutants, giving examples of each and their sources. 5,5,5

6. (*a*) Explain the hydrological cycle in detail. How can water pollution disrupt this cycle ?

(*b*) What are the major sources of water pollution ? Classify pollutants based on their nature and provide examples of each.

(*c*) Enlist and explain the various techniques for measuring water pollution. (At least *three*) 5,5,5

7. (*a*) Define DO. How is DO measured in a water sample ?

(*b*) Compare and contrast reverse osmosis, ion exchange and electro-dialysis as water purification methods.

(*c*) How can industrial waste be managed to reduce water pollution ? Discuss preventive and treatment-based strategies. 5,5,5

8. Write short notes on any *three* of the following :

(*a*) Nuclear Waste Management

(*b*) Group Displacement Law in Radioactivity

(*c*) Scintillation Detector

(*d*) Carbon-dating Technique 5,5,5