This question paper contains 4 printed pages]

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

S. No. of Question Paper : **1568**

Unique Paper Code : **222663** **C**

Name of the Course : **B.Sc. Physical Science (PHPT-606)**

Semester : **VI**

Duration : **3 Hours** Maximum Marks : **75**

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

Attempt any *five* questions.

All questions carry equal marks.

1. (*a*) Find the reciprocal lattice vectors for

$$\mathbf{a}=3\mathbf{i},\ \mathbf{b}=3\mathbf{j},\ \mathbf{c}=\mathbf{i}+\mathbf{j}+\mathbf{k}$$ 5

(*b*) State Bragg's diffraction law. Describe the Laue method or the powder method of X-ray diffraction method. 10

2. (*a*) Explain polarizability of atoms and molecules. Discuss what are its sources. Obtain Clausius-Mossotti relation between polarizability and dielectric constant of a solid. 10

P.T.O.

(*b*) Derive the relationship between displacement vector **D**, polarization vector **P** and electric field intensity **E**. 5

3. (*a*) Derive Curie's law for paramagnetism. 9

(*b*) Distinguish between diamagnetic, paramagnetic and ferromagnetic materials. 6

4. (*a*) Explain superconductivity. What are type I and type II superconductors ? 5

(*b*) Discuss Kronig-Penny model for energy band structure of solids. 10

5. (*a*) What is 'mass defect' and 'binding energy' ?

Draw a curve showing the variation of binding energy per nucleon with respect to mass number of atom. Explain. 10

(*b*) Compare the binding energy per nucleon of tritium ($_1H^3$) and the light helium isotope ($_2He^3$). Mass of neutron = 1.008665 u, mass of hydrogen atom = 1.007825 u, mass of proton = 1.007276 u, mass of $_1H^1$ = 3.016 u, mass of $_2He^3$ = 3.016 u. 5

6. (*a*) Describe radioactive decay law. Derive the relation between disintegration constant (λ) and Half-life of radioactive substance. 8

(*b*) Explain (1) Nuclear isomerism; (2) Nuclear fusion. 2+5

7. (*a*) Complete the following reactions :

(*i*) ${}_{Z}X^{A} \rightarrow ?? + {}_{2}He^{4}$

(*ii*) ${}_{Z}X^{A} \rightarrow ?? + e^{-}$

(*iii*) ${}_{Z}X^{A} \rightarrow ?? + e^{+}$

(*iv*) ${}_{Z}X^{A} + e^{-} \rightarrow ??$

(*v*) $p \rightarrow n + e^{+} + ?$ 5

(*b*) Explain Liquid-drop model of a nucleus. 10

P.T.O.

8. (*a*) Name *four* types of fundamental interactions mentioning (*i*) particles which are affected, (*ii*) particles which are exchanged. Which one is the strongest and which one the weakest of these four ? Which *two* has the longest range ? 10

(*b*) Write a short note on Hadrons. 5