

FINAL YEAR B.Sc. DEGREE EXAMINATION, MARCH/APRIL 2005

Part III—Group II—Physics

Paper IV—MODERN PHYSICS

Time : Three Hours

Maximum : 50 Marks

Section A

*Answer any two questions.
Each question carries 6 marks.*

1. State the postulates of Bohr atom model. Obtain expressions for the radius of the n^{th} orbit and energy of the electron in the n^{th} orbit.
2. Describe X-ray spectrometer and explain the method of determining the wavelength of X-rays.
3. Explain photoelectric effect. Describe Millikan's experiment to verify Einstein's equation.
4. What is the meaning of mass-energy equivalence ? Obtain Einstein's mass-energy relation. Show that $1 \text{ a.m.u.} = 931 \text{ MeV}$.

(2 × 6 = 12 marks)

Section B

*Answer any four questions.
Each question carries 3 marks.*

5. State and explain Pauli's exclusion principle as applied to electrons in atom.
6. Derive Bragg's law of X-ray diffraction in crystals.
7. Write a short note on elementary particles.
8. Describe a GM counter and explain its working as a particle detector.
9. Derive an expression for the energy of a particle in one dimensional box.
10. State and explain the basic postulates of Einstein's Special theory of relativity.

(4 × 3 = 12 marks)

Section C

*Answer any seven questions.
Each question carries 2 marks.*

11. What is Newtonian relativity ?
12. What are Miller indices in a crystal ?
13. What is the principle of photoelectric cell ?
14. What is Zeeman effect ?
15. State Compton effect.

16. What do you understand by the terms Eigenvalues and Eigenfunctions ?
17. Define Mass defect and Binding energy.
18. Define Mean life of an element.
19. Distinguish between Controlled and Uncontrolled chain reactions.
20. What are cosmic rays ?
21. Name the different types of quarks.

(7 × 2 = 14 marks)

Section D

*Answer any four questions.
Each question carries 3 marks.*

22. The K_{α} line of Molybdenum has a wavelength of 0.7078 \AA . Calculate the wavelength of K_{α} line of copper. Atomic number of Molybdenum = 42 and atomic number of copper = 29.
23. In a first order X-ray diffraction, the wavelength of X-rays is equal to the interplanar distance. What is the glancing angle ?
24. Calculate the binding energy of ${}^7_3\text{Li}$. Mass of lithium = 7.016004 a.m.u. Mass of proton = 1.007825 a.m.u. and Mass of neutron = 1.008665 a.m.u.
25. A radioactive substance has a half life period of 30 days. Calculate the radioactive disintegration constant and mean life period.
26. The total energy of a particle is exactly twice its rest energy. Calculate its speed in terms of velocity of light.
27. If the wavelength of an electron beam is 3.31 \AA . Calculate the velocity of electron beam.
28. Calculate the first energy level of an electron in a box of 1 \AA wide.

(4 × 3 = 12 marks)