

B.Sc. (Regular) DEGREE EXAMINATION, MARCH 2009.

(Examination at the end of Third Year)

Part II – Physics

Paper IV – MODERN PHYSICS

(For Mathematics Students)

**Time:** Three hours

Maximum: 100 marks

**PART A – (2 x 15 = 30 marks)**

Answer any TWO questions.

1. Explain the continuous spectrum of X – rays
2. What is Raman effect? Describe an experimental setup to study Raman effect. Write the applications of Raman effect.
3. What is photo electric effect? State the laws of photo electric emission. Discuss Einsteins theory to explain the photoelectric effect.
4. Derive Schrodinger (a) time independent and (b) time dependent equations for matter waves.

**PART B – (2 x15 = 30 marks)**

Answer any TWO questions.

5. Describe the principle, construction and working of cloud chamber. Write its advantages and disadvantages.
6. What are nuclear reactions? Explain different types of nuclear reactions.
7. Explain the structure of NaCl and CsCl crystals.
8. Explain Weiss theory of ferromagnetism.

**PART C – (5x 4 = 20 marks)**

Answer any FIVE questions.

9. Explain L-S and J-J coupling.
10. Explain Mosley's law.
11. Derive an expression for the wavelength of matter waves.
12. State postulates of quantum mechanics.
13. Explain nuclear fission and fusion.
14. Write the characteristics of ionic crystals.
15. Write the characteristics of nuclear forces.

16. Write a short note on super conductivity.

**PART D – (4 x 5 = 20 marks)**

Answer any **FOUR** questions

17. An X-ray tube operated at 40 KV emits a continuous X-ray spectrum with a short wavelength limit  $\lambda_{\min} = 0.310 \text{ \AA}$ . Calculate Planck's constant  $C = 3 \times 10^8 \text{ ms}^{-1}$ .
18. The exciting line in an experiment is  $5460 \text{ \AA}$  and the stokes line is at  $5520 \text{ \AA}$ . Find the wavelength of antistokes lines.
19. An electron has a speed of  $3.5 \times 10^7 \text{ cm/sec}$  accurated to 0.0098% with what fundamental accuracy can we locate the position of electron (Mass of electron =  $9.11 \times 10^{-31} \text{ kg}$ ).
20. Find the energy of the neutron in units of electron volts whose de Broglie wavelength is  $1 \text{ \AA}$ . Mass of the neutron  $m = 1.674 \times 10^{-27} \text{ kg}$  and Planck's constant  $h = 6.6 \times 10^{-34} \text{ Joules - S}$ .
21. A nucleus of mass number 125 has radius 6 fermi. Find the radius of a nucleus having mass number 64.
22. If 7.2 g of uranium is completely converted into energy, how many KWH energy is obtained.
23. The spacing between the principal planes of NaCl crystal is  $2.82 \text{ \AA}$ . It is found that the first order Bragg reflection occurs at an angle of  $10^\circ$ . What is the wavelength of X-rays?
24. In a crystal, a lattice plane cuts intercepts of  $2a$ ,  $3b$  and  $6c$  along the three axes where  $a$ ,  $b$  and  $c$  are primitive vectors of the unit cell. Determine the Miller indices of the given plane.

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