(7 pages) Reg. No. : .....

Code No. : 20039 E Sub. Code : AMPH 53

B.Sc. (CBCS) DEGREE EXAMINATION, APRIL 2025.

Fifth Semester

Physics — Core

ATOMIC AND NUCLEAR PHYSICS

(For those who joined in July 2020 only)

Time : Three hours Maximum : 75 marks

PART A — (10 × 1 = 10 marks)

Answer ALL questions.

Choose the correct answer :

1. Hall effect can be used to measure
   (a) Magnetic field intensity
   (b) Electric field intensity
   (c) Carrier concentration
   (d) None of the above

2. Aston's mass spectrograph is used to identify various ———— of an element.
   (a) isotopes (b) charges
   (c) structures (d) spectral lines

3. The vector atom model is based on ————
   (a) concept of special quantization
   (b) concept of electron spin
   (c) all the above
   (d) none of the above

4. The set of four quantum number. For an electron in an atom is ————
   (a) (n, l, m_l, m_s) (b) (MP, Mn, z, p)
   (c) (Z, P, n, e) (d) (P, Q, R, S)

5. The wavelength range of X-rays is ————
   (a) 1 min to 700 nm
   (b) 400nm to 1 nm
   (c) 1 nm to 0.001 nm
   (d) 0.1 m to 1 mm

6. Cosmic rays are made up of

(a) Electrons (b) Protons

(c) Atomic nuclei (d) All the above

7. The binding energy per nucleon in the nucleus or an atom (Fe=55) is approximately.

(a) 8.8 eV (b) 8.8 KeV

(c) 8.8 MeV (d) 8.8 J

8. Which of the following is not accelerated by cyclotron.

(a) electrons (b) neutrons

(c) both of these (d) none of these

9. Which of the following forms the basis of a nuclear reactor?

(a) Uncontrolled chain reaction

(b) Fast nuclear reaction

(c) Controlled chain reaction

(d) Catalyst controlled nuclear reaction

10. Nuclear fission can be explained by

(a) Proton-proton cycle

(b) Shell model of nucleus

(c) Liquid drop model of nucleus

(d) Independent of nuclear model of nucleus

PART B — ($5 \times 5 = 25$ marks)

Answer ALL questions, choosing either (a) or (b).

Each answer should not exceed 250 words.

11. (a) State the hall effect. Derive the expression for hall voltage and hall coefficient with neat diagram.

Or

(b) What is Positive rays? Write the properties of positive rays.

12. (a) Explain L-S coupling scheme for two valence electron system using neat vector diagram.

Or

(b) State and explain stark effect.

13. (a) Determine Laue's Method of X-ray Diffraction.

Or

(b) State and derive the expression of absorption of X-rays.

14. (a) Explain the salient features of nuclear Shell model.

Or

(b) With necessary theory, explain working Betatron.

15. (a) Describe the types of nuclear fusion reactor.

Or

(b) Explain the four types of fundamental interaction between elementary particles.

PART C — (5 × 8 = 40 marks)

Answer ALL questions, choosing either (a) or (b).

Each answer should not exceed 600 words.

16. (a) Deduce a mathematical expression for electrical conductivity and thermal conductivity of a conducting material.

Or

(b) Describe Thomson's parabola method to measure the specific charge of positive ions.

17. (a) Describe vector atom model and explain different quantum numbers associated with it.

Or

(b) Describe the theory and experimental verification of Normal Zeeman effect.

18. (a) Working principle of Power method of X-ray diffraction with neat diagram.

Or

(b) Write a short notes on :

(i) Cosmic ray showers.

(ii) Van Allen belts.

19. (a) List out the properties of,

(i) α -rays

(ii) β -rays

(iii) γ -rays

Or

(b) Describe a G.M Counter and its working about to be a mention is merit.

20. (a) Distinguish between nuclear fission and nuclear fusion.

Or

(b) Explain the working of hydrogen bomb.
