(6 pages) **Reg. No. :** .....

Code No. : 30456 E **Sub. Code : CMPH 53**

B.Sc. (CBCS) DEGREE EXAMINATION, NOVEMBER 2024.

Fifth Semester

Physics — Core

ATOMIC AND NUCLEAR PHYSICS

(For those who joined in July 2021–2022 only)

Time : Three hours Maximum : 75 marks

PART A — (10 × 1 = 10 marks)

Answer ALL questions.

Choose the correct answer :

1. Band gap energy of germanium is

   (a) 0.67 eV (b) 0.2 eV

   (c) 6 eV (d) 1.2 eV

2. An electric charge moving in a perpendicular magnetic field describes ———— path.

   (a) elliptical (b) circular

   (c) parabolic (d) linear

3. Wavelength of sodium D_2 line is

   (a) 5896 A° (b) 5893 A°

   (c) 5890 A° (d) 6300 A°

4. Anomalus Zeeman effect takes place in

   (a) strong electric field

   (b) strong magnetic field

   (c) weak electric field

   (d) weak magnetic field

5. In power diffractometer, the sharpness of the lines is greatly determined by

   (a) quality of the sample, size of the slit

   (b) thickness of the slit, amount of the sample

   (c) quality of the slit, size of the sample

   (d) number of slits, composition of sample

6. Charged particles are trapped to form Van Allen belt due to ———— field.

   (a) magnetic (b) electric

   (c) gravitational (d) electromagnetic

7. Magic numbers are

   (a) Liquid drop model (b) Shell model

   (c) Bohr atom model (d) Vector atom model

8. When a radioactive nucleus undergoes alpha decay its mass number is

(a) increased by 4 units

(b) decreased by 4 units

(c) increased by 2 units

(d) decreased by 2 units

9. Hydrogen bomb work on the principle of

(a) alpha decay (b) beta decay

(c) nuclear fusion (d) nuclear fission

10. Which of the following are leptons?

(a) electron (b) neutrino

(c) muon (d) all of these

PART B — ($5 \times 5 = 25$ marks)

Answer ALL questions choosing either (a) or (b).
Each answer should not exceed 250 words.

11. (a) Deduce expression for electrical conductivity.

Or

(b) Give the advantages and disadvantages of Thomson's parabola method.

12. (a) Explain the vector model of atom.

Or

(b) Calculate the wavelength separation between the unmodified line of wavelength 6000Å and the modified lines when a magnetic induction of 1 Wbm^{-1} is applied, in normal Zeeman effect. Also write down the wave length of modified lines.

13. (a) What are called X-rays? List its properties.

Or

(b) What are cosmic ray showers? How are they produced?

14. (a) List out the properties of alpha rays.

Or

(b) Describe the construction and working of Betatron.

15. (a) Explain the nuclear chain reaction.

Or

(b) Write notes on 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) Explain the classification of solids on the basis of band theory of solids.

Or

(b) Describe the construction and working of Aston's mass spectrograph.

17. (a) Describe Stern and Gerlach experiment with relevant theory. Discuss the importance of the result obtained.

Or

(b) What is Zeeman effect? Give the quantum mechanical explanation. Sketch the Zeeman pattern for f to d transition.

18. (a) Describe rotating crystal method to determine the cell dimensions of a crystal.

Or

(b) Analyse the effects of altitude and latitude on cosmic rays.

19. (a) What are the similarities between a liquid drop and a nucleus? Describe liquid drop model.

Or

(b) With a neat sketch and relevant theory, explain the construction and working of cyclotron.

20. (a) Explain nuclear fusion. Describe the action of hydrogen bomb.

Or

(b) Explain the quark model.

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