

(6 pages)

Reg. No. :

Code No. : 20351 E Sub. Code : EMPH 52

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

Fifth Semester

Physics — Core

ATOMIC AND NUCLEAR PHYSICS

(For those who joined in July 2023 onwards)

Time : Three hours

Maximum : 75 marks

PART A — (10 × 1 = 10 marks)

Answer ALL questions.

Choose the correct answer :

- The value of spin quantum number of an electron is
(a) $1/2$ (b) 1
(c) 2 (d) 0
- For p-electron the orbital angular momentum is
(a) 0 (b) 1
(c) 2 (d) 3

- Zeeman effect is _____ phenomena.
(a) electric
(b) optic
(c) magneto-optic
(d) magnetic
- The wavelength of sodium D_1 line is
(a) 5890 Å (b) 5893 Å
(c) 5894 Å (d) 5896 Å
- The size of nucleus is of the order of
(a) 10^{-15} mm (b) 10^{15} m
(c) 10^{-15} m (d) 10^{-15} cm
- Which one of the following is a magic number regarding nuclei?
(a) 10 (b) 20
(c) 30 (d) 40
- Which of the following has more penetrating power?
(a) gamma rays
(b) beta rays
(c) alpha rays
(d) photon

8. Who discovered radioactivity?

- (a) Marie Curie
- (b) Henry Becquerel
- (c) Rutherford
- (d) Neils Bohr

9. Atom bomb works on the principle of

- (a) alpha decay
- (b) beta decay
- (c) nuclear fission
- (d) nuclear fusion

10. An example for charged particle detector is _____.

- (a) Scintillation counter
- (b) GM counter
- (c) Cloud chamber
- (d) All of these

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PART B — (5 × 5 = 25 marks)

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

Each answer should not exceed 250 words.

11. (a) Describe, with a neat sketch, LS coupling.

Or

(b) Describe the experimental setup of Stern-Gerlach.

12. (a) Describe the term spectral notations.

Or

(b) Explain Stark effect.

13. (a) Calculate the mass defect, binding energy and binding energy per nucleon of ^{16}O . Given that mass of ^{16}O is 15.9949 amu.

Or

(b) List the characteristics of nuclear forces.

14. (a) The half-life of radium is 1590 years. In how many years will one gram of radium be (i) reduced by one centigram (ii) reduced to one centigram.

Or

(b) Describe the continuous beta ray spectrum.

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[P.T.O.]

15. (a) Discuss the energy released in fission reaction.

Or

(b) What are called radio isotopes? Give their applications.

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 vector model of the atom. Also discuss any three quantum numbers associated with it.

Or

(b) Obtain an expression for magnetic moment of an electron due to orbital motion and spin motion. Also derive the expression for total magnetic moment of the electron.

17. (a) What is Zeeman effect? Give the quantum mechanical explanation.

Or

(b) Describe anomalous Zeeman effect with relevant theory. Also discuss the fine structure of sodium D lines.

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18. (a) Describe the liquid drop model of the nucleus and give the merits of this model.

Or

(b) Explain the Shell model of the nucleus.

19. (a) List the properties of alpha, beta and gamma rays.

Or

(b) Explain the Gamow's theory of alpha decay.

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

Or

(b) Describe the construction and working of GM counter.

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