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Reg. No. : .....

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

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

Fifth Semester

Physics – Core

ATOMIC AND NUCLEAR PHYSICS

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

Time : Three hours

Maximum : 75 marks

PART A — (10 × 1 = 10 marks)

Answer ALL questions.

Choose the correct answer :

1. The value of intrinsic spin of electron is

- (a)  $h$  (b)  $\frac{h}{2\pi}$   
(c)  $\frac{h}{4\pi}$  (d) zero

2. The Planck's constant is

- (a)  $6.626 \times 10^{-34}$  J-S  
(b)  $1.6 \times 10^{-19}$  J-S  
(c)  $9.1 \times 10^{-31}$  J-S  
(d)  $1.6 \times 10^{-34}$  J-S

3. One fermi is

- (a)  $1 \times 10^6$  disintegrations/sec  
(b)  $1 \times 10^{-10}$  m  
(c)  $1 \times 10^{-15}$  m  
(d)  $3 \times 10^8$  m

4. One atomic mass unit (u) is

- (a) 931 MeV  
(b)  $1.66 \times 10^{-27}$  kg  
(c)  $1 \times 10^{-15}$  kg/m<sup>3</sup>  
(d) both (a) and (b)

5. Which one has highest penetrating power?

- (a) alpha rays (b) beta rays  
(c) gamma rays (d) (a) and (b)

6. Alpha particle is  
(a) electron  
(b) nucleus of helium atom  
(c) nucleus of hydrogen atom  
(d) all the above

7. Cyclotron frequency is  
(a)  $f = \frac{qB}{2\pi}$                       (b)  $f = \frac{q}{2\pi m}$   
(c)  $f = \frac{qB}{2\pi m}$                       (d)  $f = \frac{2\pi m}{qB}$

8. Betatron is a machine used to accelerate  
(a) helium atom  
(b) neutrons  
(c) electrons  
(d) all the above

9. The energy of primary cosmic rays is of the order.  
(a)  $10^8$  KeV                      (b)  $10^6$  MeV  
(c)  $10^{-8}$  MeV                      (d) 1.33 eV

10. The intensity of cosmic rays is minimum at  
(a) the equator  
(b) the polar  
(c) western companies  
(d) none

PART B — (5 × 5 = 25 marks)

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

Answer should not exceed 250 words.

11. (a) Explain the vector atom model.  
Or  
(b) Explain L-S coupling.
12. (a) Write a short note on : Nuclear properties of an atom.  
Or  
(b) Write a short note on : Binding energy curve.
13. (a) Define : Radioactivity. Briefly explain the term : radioactivity.  
Or  
(b) Write a short note on : Radioactive decay law.

14. (a) Explain the following :

- (i) Nuclear fission
- (ii) Chain reaction.

Or

(b) Write a short note on : Thermonuclear reaction.

15. (a) Write a short on : Cosmic rays.

Or

(b) Explain : Quark's model.

PART C — (5 × 8 = 40 marks)

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

Answer should not exceed 600 words.

16. (a) Explain : vector atom model and the quantum numbers associated with it.

Or

(b) Explain the following :

- (i) Stark effects
- (ii) Pauli exclusion principle.

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17. (a) Write a short note on :

- (i) proton-electron hypothesis
- (ii) proton-neutron hypothesis.

Or

(b) Sketch, explain and assumptions of shell model of nucleus.

18. (a) Write a short note on :

- (i) Soddy-Fajan's displacement law
- (ii) Law of radioactive disintegration.

Or

(b) Define :  $\alpha$ -decay. Give the theory of  $\alpha$ -decay. State its main features.

19. (a) Explain the principle, construction, working and uses of nuclear reactors.

Or

(b) Describe the construction, principle, working and uses of Wilson's cloud chamber.

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20. (a) Explain the constituents of cosmic rays.

Or

(b) Write a short note on : Elementary particles.

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