

[This question paper contains 3 printed pages.]

1917

Your Roll No.

B.Sc. Prog./III

E

PH-302 – PHYSICS – MODERN PHYSICS

(Admissions of 2008 and onwards)

Time : 3 Hours

Maximum Marks : 75

(Write your Roll No. on the top immediately
on receipt of this question paper.)

Attempt **five** questions in all.

Question No. 1 is compulsory.

1. Answer any **five** of the following:

- (a) What do understand by the binding energy of the nucleus? Explain.
- (b) If a system has angular momentum characterized by the quantum number $l = 3$. What are the possible values of L_z and the magnitude of L ?
- (c) Explain the phenomena of ozone loss.
- (d) What is gluon? Is a free gluon observed? Explain.
- (e) What is meta stable state? Explain its significance in the working of LASER.

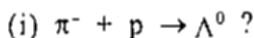
P.T.O.

- (f) Using the concept of anti-symmetric wave function, show that no two electrons can exist in the same quantum state.
- (g) What are aerosols and mention different sources of aerosols. (5×3)
2. (a) Distinguish between phase velocity and group velocity. Find the relation between them. (4+4)
- (b) Describe wave nature of electrons by Davission and Germer experiment. (7)
3. (a) What are Einstein's coefficients? Establish the relation between the coefficients. (4+6)
- (b) What is population inversion? Why is it necessary for the operation of a laser? (5)
4. (a) What is Normal Zeeman effect? Obtain an expression for Zeeman shift. (2+8)
- (b) Which of the elements H, He, Li, Mg and Na show Normal Zeeman effect and why? (2)
- (c) The Zeeman component of a 500nm spectral lines are 0.0116nm apart, when magnetic field is 1T. Find the ratio of e/m for the electron. (3)
5. (a) What is beta decay? Explain why beta decay spectrum is continuous. (2+8)

- (b) Show that ^{55}Fe undergo electron capture, but not β^+ decay.

$$\begin{aligned} \text{Given } M(^{55}\text{Fe}_{26}) &= 54.938298\text{u}, \quad M(^{55}\text{Mn}_{25}) \\ &= 54.938050\text{u. and } m_e = 0.000549\text{u.} \end{aligned} \quad (5)$$

6. (a) What are fundamental forces in nature? Give their relative strengths and range. (6)
- (b) Using Conservation laws of quantum numbers, complete the following reactions.



- (c) Write the quark content of neutron and proton? Assuming the quark structure of the neutron and proton give the corresponding β decay $n \rightarrow p + e^- + \bar{\nu}_e$ in terms of quarks. (5)

7. Discuss composition and layers of the Earth's atmosphere. Discuss strong influence of Solar activity on the structure of the Earth's atmosphere.

(9+6)