

22100926

QP CODE: 22100926

Reg No : .....

Name : .....

**B.Sc DEGREE (CBCS ) REGULAR / REAPPEARANCE EXAMINATIONS,  
APRIL 2022**

**Sixth Semester**

**CORE - PH6CRT10 - RELATIVITY AND SPECTROSCOPY**

Common for B.Sc Physics Model I, B.Sc Physics Model II Applied Electronics, B.Sc Physics Model II Computer Applications & B.Sc Physics Model III Electronic Equipment Maintenance

2017 Admission Onwards

E17A7579

Time: 3 Hours

Max. Marks : 60

**Part A**

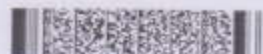
*Answer any ten questions.*

*Each question carries 1 mark.*

1. What are inertial frames of reference?
2. Write down the Galilean transformation equations.
3. Write down Lorentz transformation equations.
4. Explain how the binding energy per nucleon is explained based on mass energy equivalence.
5. List any two physical phenomena explained with the help of quantum theory of radiations.
6. What is the relation between  $S$  and  $M_s$ ?
7. What is the value of spin angular momentum?
8. Write an expression to find out Lande  $g$  factor using quantum numbers  $L$ ,  $S$  and  $J$ .
9. Define fluorescence.
10. Name the main components of a microwave spectrometer.
11. List the basic requirements for a NMR spectrometer.
12. What is the application of ESR?

(10×1=10)





### Part B

Answer any **six** questions.

Each question carries **5** marks.

13. Assuming Lorentz-Fitzgerald contraction, calculate the apparent length of a meter scale moving at a speed of  $2.5 \times 10^8$  m/s.
14. At what speed is a particle moving if the mass is equal to three times its rest mass.
15. Write a note on general theory of relativity.
16. With the help of a diagram, explain  $\alpha$  particle scattering experiment.
17. A beam of electrons bombards a sample of Hydrogen. Through what potential difference must the electrons be accelerated if the first line of Balmer series is to be emitted?
18. Determine possible values of total angular momentum of an f electron according to vector atom model.
19. Compare the intensities of spectral lines of CO molecule for the spectral lines  $J=1$  to  $0$  and  $J=2$  to  $1$  at  $300$  K. Given that  $2B=3.84235$ . Mass of Carbon atom is  $12.000 \times 1.67343 \times 10^{-27}$  kg, and that of oxygen atom is  $16.9994 \times 1.67343 \times 10^{-27}$  kg.
20. The fundamental vibration frequency of HCl is  $2989 \text{ cm}^{-1}$  find the force constant of HCl molecule. Given  $m_H = 1.673 \times 10^{-27}$  kg,  $m_{Cl} = 58.06 \times 10^{-27}$  kg.
21. With neat diagram explain the experimental setup to observe Raman effect.

(6×5=30)

### Part C

Answer any **two** questions.

Each question carries **10** marks.

22. Explain three consequences of Lorentz transformations.
23. Discuss the addition of velocities and prove that nothing can travel faster than  $c$ .
24. Discuss the quantum theory of anomalous Zeeman Effect.
25. Explain the quantum theory of Raman spectroscopy of molecules. How it differs from that of the classical theory? How the intensity of Stokes and anti-Stokes lines can be explained by quantum theory of Raman Effect?

(2×10=20)

