

B. Sc. DEGREE END SEMESTER EXAMINATION - MARCH 2020**SEMESTER – 6: PHYSICS (CORE COURSE)****COURSE: 15U6CRPHY12: RELATIVITY AND SPECTROSCOPY***(Common for Regular 2017 Admission & Supplementary 2016 /2015/2014 Admissions)*

Time: Three Hours

Max. Marks: 60

PART A (Very short answer questions)***Answer all questions, each question carries 1 Mark***

1. The proper length of a rod is 1m. The length of the rod when it moves with a speed which is 60% of the speed of light in vacuum will be.....
2. The minimum energy required by a gamma ray photon for producing electron-positron pair is
3. The General Theory of Relativity deals with frames of reference.
4. Briefly explain Thomson's atom model.
5. The experiment proved the spatial quantization of angular momentum.
6. An electron with orbital angular momentum quantum number $l = 1$ is called aelectron.
7. ESR spectra is observed in the ----- region of electromagnetic spectrum.
8. Only molecules can give rotational spectrum.
9. A diatomic molecule vibrates simple harmonically with a frequency ν . The lowest vibrational energy of the molecule is
10. In Raman spectrum, lines having frequency greater than that of exciting line are called

(1 x 10 = 10)

PART B (Short answer)***Answer any Seven questions, each question carries 2 Marks***

11. Write down the Galilean transformation equations.
12. Give the postulates of special theory of relativity.
13. Explain how does the mass of a particle vary with velocity.
14. State and explain Pauli exclusion principle.
15. Explain LS coupling scheme.
16. What is Normal Zeeman effect?
17. Explain how electronic band spectrum is produced.
18. Write a note on microwave spectrum of a diatomic molecule.
19. Explain fluorescence with practical applications.

(2 x 7 = 14)

PART C (Problem/Derivations)**Answer any Four question Each question carries 4 Marks**

20. Show that, when the velocity v is small, the relativistic expression for kinetic energy reduces to $\frac{1}{2}mv^2$.
21. How fast would a rocket go relative to an observer for its length to be contracted to 99% of its length at rest.
22. The wavelength of the first line of the Balmer series is 6563 \AA . Calculate wavelength of the second line of the Balmer series.
23. Calculate the magnetic field required to observe the NMR spectrum of the proton in benzene at 120MHz. Given $g_N = 5.385$. Nuclear magneton = $5.051 \times 10^{-27} \text{ JT}^{-1}$.
24. The first line in the rotational spectrum of Carbon monoxide appears at 3.8424 cm^{-1} . (1) Calculate the moment of inertia of the molecule. (2) the lowest non-zero rotational energy of the molecule.
25. A substance shows Raman line at 4570 \AA when excited by radiation of 4768.5 \AA . Find the positions of Stokes and anti-Stokes lines for the substance when excited by radiation of wavelength 4047 \AA . (4 x 4 = 16)

PART D (Long answer questions)**Answer any Two question, each question carries 10 Marks**

26. Describe the Michelson-Morley experiment. What was the result and what is the importance of the result?
27. Starting from Lorentz transformation equations, obtain the expression for length contraction and time dilation. Also derive the velocity addition law in relativity.
28. Discuss the quantum numbers associated with the vector atom model. Explain Paschen-Back effect on the basis of vector atom model.
29. Discuss the theory of vibrational spectrum of a diatomic molecule treating it as a simple harmonic oscillator (10 x 2 = 20)
