

Final Year B.Sc., Degree Examination**August / September 2009****Directorate of Correspondence Course****Physics****Paper - III : Modern Physics - I****Spectroscopy, Wave Mechanics, Statistical Mechanics,
Relativity & Astrophysics**

Time : 3 Hours

Max. Marks : 75

Instructions:

- (1) Answer Section - A in the first two pages of the main answer book.
- (2) Answer ALL questions in Section - A, FIVE questions in Section - B, FIVE questions in Section - C & TWO questions in Section - D.
- (3) Draw neat and labelled diagrams wherever necessary.
- (4) Take the necessary data from the tables.

SECTION - A**I. Answer ALL the questions.****10x1=10 marks**

1. What were the de-merits of Rutherford's atom model?
2. What is Stark effect?
3. State selection rules for spectral transitions.
4. What are characteristic x-rays?
5. State Rayleigh's law of scattering of light.
6. What is the average life time of metastable state?
7. The de Broglie wavelength of a moving cricket ball cannot be detected. Why?
8. Define astronomical unit.
9. State Hubble's law.
10. What is "Minkowski world"?

SECTION - B**II. Answer any FIVE questions.****5x3=15 marks**

11. Find the ratio of mass of electron to that of proton. Given Rydberg constants.
 $R_{He} = 1.09677 \times 10^7 m^{-1}$ & $R_H = 1.09722 \times 10^7 m^{-1}$.
12. State & explain Pauli's exclusion principle.
13. Distinguish between Raman spectra & IR spectra.
14. State & explain Maxwell - Boltzmann's distribution law.
15. Explain the equivalence of "inertial mass" & "gravitational mass".

16. Explain the physical significance of the wave function Ψ .
17. The star Epsilon - Indi is at a distance of 11.82 light years & has a brightness $6.7045 \times 10^{-10} \text{ Wm}^{-2}$. Calculate its Luminosity.

SECTION - C

III. Answer any FIVE questions.

5x6=30 marks

18. With necessary theory, describe Thomson's experiment for the determination of $\frac{e}{m}$ of electron.
19. Describe Stern-Gerlach experiment & mention its results.
20. Derive Bragg's law of x-ray diffraction.
21. Describe the construction & working of a He-Ne Laser with the help of energy level diagram.
22. Solve the Schrodinger's wave equation for the allowed energy values of a particle in a one dimensional potential well.
23. Describe Michelson-Morley experiment & discuss its significance.
24. What is a HR diagram ? How it is used to account for the properties of stars?

SECTION - D

IV. Answer any TWO questions.

2x10=20 marks

25. a) Give quantum mechanical explanation of normal Zeeman effect. 7 marks
 b) An X-ray tube has an accelerating potential of 50kV. If the minimum wavelength present in its spectrum is 0.2487 \AA , evaluate Planck's constant. 3 marks
26. a) Give the theory of Compton effect. 7 marks
 b) With the exciting radiation of wave length 435.8nm, a Raman line at a wavelength 462.4nm was observed. Find the corresponding anti-stokes line. 3 marks.
27. a) Deduce Einstein's mass - energy relation. 6 marks
 b) What is "Time Dilation" ? Explain it with an experimental evidence. 4 marks
28. a) Write a note on stellar magnitudes and hence state mass - luminosity relation. 6 marks
 b) Using uncertainty principle, show that electrons do not exist inside the nucleus. 4 marks

* * *