

Third Year B.Sc., Degree Examinations**September /October 2015***(Directorate of Distance Education.)***PHYSICS****DSC 210 : Paper III : Spectroscopy, Wave Mechanics, Statistical Mechanics, Relativity and Astrophysics***Time: 3 hrs.]**[Max.Marks:75/85*

- Instructions :*
- 1. Students who have attended 25 Marks IA Scheme will have to answer for total of 75 Marks.*
 - 2. Students who have attended 15 Marks IA Scheme will have to answer for total of 85 Marks.*
 - 3. Section E is compulsory for 85 Marks Scheme only.*

SECTION - A**I. Answer ALL the questions.****(10X1=10)**

1. What is the rest mass of photon moving with velocity of light ?
2. What is world line ?
3. What is the time required for light to travel from a star at a distance of 8 light years to reach earth ?
4. Define phase space.
5. What type of particles exhibits wave nature ?
6. How the population inversion is achieved in Ruby laser ?
7. Write the application of laser in medical field.
8. What is Paschen – Back effect ?
9. Give the expression for the maximum number of electrons in the orbit of principal quantum number 'n'.
10. Define Bohr magneton.

SECTION - B**II. Answer any FIVE questions.****(5X3=15)**

11. State Moseley's law. Write its significance.
12. Explain the terms i) active medium ii) cavity resonator and iii) Population inversion.
13. Obtain relativistic energy – momentum relation.
14. Compare the wave length of matter waves associated with electron and proton moving with same velocity.

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15. Explain gravitational bending of star light.
16. Distinguish between M.B, F.D and B.E statistics.
17. What is H.R diagram ? Explain.

SECTION - C

III. Answer any FIVE questions. (5X6=30)

18. With necessary theory, discuss Thomson's method of determining e/m of an electron.
19. Describe Stern-Gerlach experiment with theory. Write its importance.
20. State Duane-Hunt rule, Derive the Bragg's law of diffraction for X – rays.
21. State and explain Uncertainty Principle. Show that the electrons can not be inside the nucleus using the principle.
22. Derive time independent form of Schrödinger's equation.
23. State postulates of special theory of relativity. Show that the phenomenon of simultaneity is relative.
24. Explain the Big-Bang theory of the universe with the experimental supports in favour of the theory.

SECTION - D

IV. Answer any TWO questions. (2X10=20)

25. a) Distinguish between normal and anomalous Zeeman effect.
b) Explain with neat diagram the experimental arrangement to observe the Zeeman effect.
c) In a normal Zeeman experiment, the calcium 4226 \AA line splits into three lines separated by 0.25 \AA in a magnetic field of 3T. Calculate the specific charge ratio of the electron. (2+5+3)
26. a) Write a note on NMR.
b) Describe the experimental arrangement to observe the Raman effect.
c) Mono – chromatic X – rays of wave length 0.15 \AA undergoes Compton effect from a Carbon block. Calculate the wavelength scattered through 60° . (2+4+4)
27. a) Set up the Schrödinger's equation for a particle in one-dimensional box and solve for Eigen functions and energy Eigen values.
b) The energy of a linear harmonic oscillator in its third excited state is 0.1 eV. Calculate the frequency of vibration. (7+3)

Contd...3

28. a) Explain the principle, construction and working of He – Ne laser.
b) The K.E of a particle is 3 times its rest mass energy. What is its velocity ?
(6+4)

SECTION - E

- V. Answer any ONE of the following questions. (1X10=10)
(Compulsory question for 85 marks scheme only)

29. a) Describe the Michelson and Morley experiment. Write the expression for fringe shift. Give the Einstein explanation of null shift in the experiment
b) Calculate the velocity of the rocket relative to an observer so that its length to be contracted to 80% of its length at rest. (6+4)
30. a) Explain the parallax method of determining the stellar distance.
b) Explain the formation of Black holes.
c) Calculate the distance modulus of star Spica which is 262.68 light years from the earth. (4+3+3)

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