RAMAKRISHNA MISSION VIDYAMANDIRA

(Residential Autonomous College under University of Calcutta)

B.A./B.Sc. FOURTH SEMESTER EXAMINATION, MAY 2014

SECOND YEAR

Date : 31/05/2014 **PHYSICS (General)**

Time : 10.30 am – 12.30 pm Paper : IV Full Marks : 50

(Use a separate Answer Book for each group)

Group – A

Answer **any three** questions :

1. a) Describe the Huygens' principle in wave theory of light. [2]
   b) Prove laws of refraction with the help of wave theory. [3]

2. a) State and explain Brewster's law in polarisation of light. [1+2]
   b) Explain the working principle of a quarter wave plate. [2]

3. Obtain the intensity distribution pattern of Young's experiment. Hence show that the width of bright and dark band are equal. [3+2]

4. Derive the theory for determination of wavelength of monochromatic light by Newton's ring method. [5]

5. What is zone plate? Derive the expression for focal length of a zone plate. [1+4]

Group – B

Answer **any three** questions :

6. A Ge-diode has a forward current of 25mA at 0·7V. Calculate the dynamic resistance at temperature 300K after deducing the required expression. [Boltzmann constant $1{\cdot}38\times10^{-23}\,JK^{-1}$] [5]

7. What is Zener diode? Explain with a circuit diagram how a Zener diode can be used as a voltage regulator. [5]

8. With neat circuit diagram explain the working principle of a Bridge rectifier. [5]

9. Find the values of α and β of a PNP transistor when $I_E = 5{\cdot}02$ mA and $I_B = 20\mu A$ Establish the relation used. [5]

10. a) Find 1101 – 0111 [1]
    b) State and explain De Morgan's theorems. [2]
    c) Obtain AND gate using NOR gate. [2]

Group – C

Answer **any four** questions :

11. a) Write and explain the velocity addition theorem in the special theory of relativity. [3]
    b) Write down the relativistic variation of mass with velocity and plot the nature of variation. [1+1]

12. State Mosley's law. Explain this law using Bohr's theory. [2+3]

13. a) State and explain Pauli's exclusion principle. [2]
    b) Find the speed of electron in hydrogen atom in the orbit of radius $0{\cdot}5\times10^{-10}$m. Given that the mass and charge of electron are $9{\cdot}1\times10^{-31}$kg and $1{\cdot}6\times10^{-19}$C respectively. [3]

14. What are Stoke's and anti-stoke's lines in Raman spectra? Explain their origin in the light of quantum theory. What is the importance of Raman effect? [2+2+1]

15. What is de Broglie wave?

A charge particle of charge q and mass m is accelerated by a potential difference V. Find the associated de Broglie wavelength. [2+3]

16. a) What do you understand by binding energy of a nucleus. [2]

b) Find out the binding energy per nucleon of $^{16}_{8}O$ nucleus.

[mass (amu) : neutron = 1·008665, proton = 1·007820, oxygen = 15·994915] [3]

17. Distinguish between fission and fusion with the help of binding energy curve. [5]