RAMAKRISHNA MISSION VIDYAMANDIRA

(Residential Autonomous College under University of Calcutta)

B.A./B.SC. FOURTH SEMESTER EXAMINATION, MAY-JUNE 2013

SECOND YEAR

Date : 29/05/2013 **Physics (General)**

Time : 11am – 1pm Paper : IV Full Marks : 50

[Use separate Answer Books for each group]

Group-A

Answer **any three** of the following questions:

1. a) State and explain Brewsten's law in Polarisation. (3)
   b) Define specific rotation of plane polarized light in solution. (2)
2. State three differences between Fresnel Diffraction and Fraunhoffer diffraction. Define resolving power of a Grating. (3+2)
3. What is a Zone-plate? How is it constructed? Show that a zone-plate has multiple foci. (1+1+3)
4. Describe Newton's rings method for measuring the wave length of monochromatic light and give the necessary theory. (5)
5. a) Prove the law of refraction using Huygen's principle. (3)
   b) Calculate the thickness of a quarter wave plate
   (given that $\mu_e = 1.553 \; and \;\; \mu_0 = 1.544 \; and \; \lambda = 5000\text{Å}$) (2)

Group-B

Answer **any three** of the following questions:

6. Explain the operation of a bridge rectifier with the help of a circuit diagram. (5)
7. What is Zener diode? Explain how Zener diode maintains constant voltage across the load? (5)
8. a) Define $\alpha \; and \; \beta$ of a transitor. (1+1)
   b) A common-emitter transistor has $\alpha = 0.98$. If the collector current is 1.2mA. Find the base current.
9. a) Determine the binary equivalents of (a) 25 and (b) 30 (3+2)
   b) Perform the binary subtraction (1101-111)
10. a) State de Morgan's theorem. (2)
    b) How can the 'NAND' gates be combined to perform 'OR' operation. (3)

Group-C

Answer **any four** of the following questions:

11. a) State basic postulates of Einstein's special theory of relativity.
    b) If the total energy of a particle is exactly twice its rest mass energy, then calculate its speed. (2+3)
12. a) What is Raman effect? (1)
    b) Compare Raman effect and Compton effect. (4)
13. a) State Heisenberg's uncertainty principle. (2)
    b) Compute the smallest possible uncertainty in the position of an electron moving with velocity $3 \times 10^7 m/sec$. The rest mass of electron is $9.1 \times 10^{-31} \; kg$. (3)

14. Derive an expression for stationary state energy eigenvalues for a particle of mass 'm' which is free to move in a region of zero potential from x=0 to x=L (5)

15. a) What do you understand by Binding Energy of the nucleus ${}_zX^A$? Write down its equation. (3)
    b) Find out the binding energy of ${}_8O^{16}$ nucleus.
    [Given: m_p=1.008412 amu, m_n=1.008982 amu, 1 amu=931 MeV.] (2)

16. Discuss the theory of successive disintegration of radioactive substance and obtain the conditions for transient and secular equilibrium. (3+2)

17. a) State Bragg's Law of x-ray diffraction in crystal. (2)
    b) The spacing of the planes in a crystal is 1.2 Å and the angle for the first order Bragg reflection is 30^0. Determine the energy of the x-ray in ev. (3)