

RAMAKRISHNA MISSION VIDYAMANDIRA

(Residential Autonomous College under University of Calcutta)

B.A./B.SC. FOURTH SEMESTER EXAMINATION, MAY 2012

SECOND YEAR

PHYSICS (General)

Date : 23/05/2012

Time : 11 am – 1 pm

Paper : IV

Full Marks : 50

Group - A

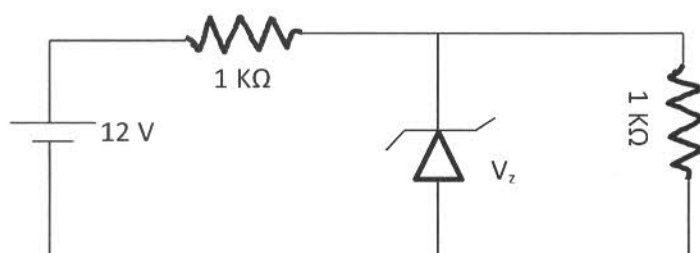
(Answer **any three** questions)

1. a) What is Huygen's principle for wave propagation? [2]
b) Prove the laws of reflection using this principle. [3]
2. a) Explain the theory of formation of Newton's ring. [2]
b) Why is the center of Newton's ring dark? [1]
c) State the conditions for sustained interference of light. [2]
3. a) What is a half wave plate? [2]
b) Calculate the thickness of a quartz half wave plate for the line 560 nm for which the extra ordinary and ordinary refractive indices of light are 1.55 and 1.53 respectively. [3]
4. a) What is zone plate? [2]
b) Explain the working principle of zone plate. [3]
5. a) What is plane diffraction grating? [1]
b) How many lines per cm are there in a grating which produces the first order maximum for a light of wavelength 6000 Å at an angle 30°? [2]
c) What is meant by resolving power of a plane diffraction grating? [2]

Group - B

(Answer **any two** questions)

6. In the given circuit of the Zener diode of $V_z = 5V$, find whether the power dissipated in the Zener diode exceeds the maximum power limits of 100 mW specified for it. [5]



7. a) Draw the CE output characteristics and indicate the saturation, cut-off and active region. [2]
b) Define α and β parameter of a transistor and derive the relation between them. [2+1]
8. a) Draw the circuit symbol of a NOR gate and write down its truth table. [2]
b) Show how can you form an AND gate using NAND gates. [2]
c) Convert $(-26)_{10}$ to binary number. [1]

Group - C

(Answer **any five** questions)

9. a) What do you mean by primitive unit cell. [2]
b) The Bragg's angle for reflection from (220) plane of nickel is 38.2° when X-ray of wavelength 0.154 nm is employed in a diffraction experiment. Determine the lattice parameter of nickel. [3]
10. a) Write down Einstein's photoelectric equation. [1]
b) What do you mean by threshold frequency? [1]
c) Work function of a metal is 1.07 eV. What will be the maximum kinetic energy of the ejected electron when light of wavelength 6000 Å is incident on that metal? [3]
11. a) State Heisenberg's uncertainty principle. [2]
b) State Pauli's exclusion principle. How is this principle applied in explaining the periodic table of elements? [3]
12. A particle of mass m is confined to a one dimensional rigid box. Derive the expressions for its energy and normalised wavefunction by solving Schrodinger's equation. [5]
13. a) What do you mean by eigenfunction and eigenvalue. [1]
b) Compare Raman effect and Compton effect. [3]
14. a) Write down the postulates of Einstein's special theory of relativity. [2]
b) A rod of length one metre is in a satellite moving with respect to the earth with velocity $0.99c$. What is the length of the rod with respect to an observer on the earth. [3]
15. a) Explain the terms, binding energy and packing fraction of a nucleus. [1+1]
b) What do you mean by nuclear fission and fusion reactions? [3]
16. a) What is meant by artificial transmutation? [1]
b) A nucleus emits an α -particle followed by two β -particles. Show that the final nucleus is an isotope of the initial one. [2]
c) The half-life of a radioactive element is 60 days. Determine its decay constant and mean-life. [2]