SAMPLE QUESTION PAPER

BLUE PRINT

Time : 2 Hours **Max. Marks** : 35

S. No.		Chapter	Section-A (2 marks)	Section-B (3 marks)	Section-C (5 marks)	Total
8.	Unit-V	Electromagnetic Waves	–	2(6)	–	6(17)
9	Unit-VI	Ray Optics and Optical Instruments	1(2)#	1(3)	–	
10.		Wave Optics	–	2(6)#	–	
11.	Unit-VII	Dual Nature of Radiation and Matter	–	1(3)	–	3(11)
12.	Unit-VIII	Atoms	–	1(3)*	–	
13.		Nuclei	–	–	1(5)	
14.	Unit-IX	Semiconductor Electronics : Materials, Devices and Simple Circuits	2(4)	1(3)		3(7)
		Total Questions	**3(6)**	**8(24)**	**1(5)**	**12(35)**

*It is a choice based questions.

#Out of the two or more questions only one question is choice based

Time : 2 Hours

General Instructions :

(i) *There are 12 questions in all. All questions are compulsory.*

(ii) *This question paper has three sections: Section A, Section B and Section C.*

(iii) *Section A contains three questions of two marks each, Section B contains eight questions of three marks each, Section C contains one case study-based question of five marks.*

(iv) *There is no overall choice. However, an internal choice has been provided in one question of two marks and two questions of three marks. You have to attempt only one of the choices in such questions.*

(v) *You may use log tables if necessary but use of calculator is not allowed.*

SECTION - A

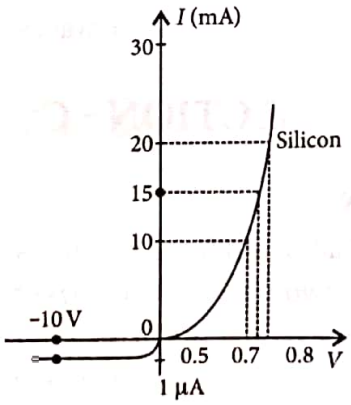
1. Plot *V-I* characteristics for an illuminated photodiode under reverse bias for three different illumination intensities $I_1 > I_2 > I_3$.

2. You are given two converging lenses of focal lengths 1.25 cm and 5 cm to design a compound microscope. If it is desired to have a magnification of 30, find out the separation between the objective and the eyepiece.

OR

In total internal reflection when the angle of incidence is equal to the critical angle for the pair of media in contact, what will be angle of refraction?

3. The *V-I* characteristic of a silicon diode is as shown in the figure. Calculate the resistance of the diode at (i) $I = 15$ mA and (ii) $V = -10$ V



SECTION - B

4. (a) Why are Si and GaAs preferred materials for fabrication in solar cells?
   (b) Draw *V-I* characteristic of solar cell and mention its significance.

5. (i) How does one explain the emission of electrons from a photosensitive surface with the help of Einstein's photoelectric equation?

(ii) The work function of the following metals is given : Na = 2.75 eV, K = 2.3 eV, Mo = 4.17 eV and Ni = 5.15 eV. Which of these metals will not cause photoelectric emission for radiation of wavelength 3300 Å from a laser source placed 1 m away from these metals? What happens if the laser source is brought nearer and placed 50 cm away?

6. Calculate the de-Broglie wavelength associated with the electron in the 2^{nd} excited state of hydrogen atom. The ground state energy of the hydrogen atom is 13.6 eV.

OR

The electron in a given Bohr orbit has a total energy of –2.0 eV. Calculate its

(i) kinetic energy. (ii) potential energy.

(iii) wavelength of radiation emitted, when this electron makes a transition to the ground state.

[Given : Energy in the ground state = –13.6 eV and Rydberg's constant = $1.09 \times 10^7\ m^{-1}$]

7. Two slits in Young's experiment have widths in the ratio 1 : 25. Find the ratio of intensity at the maxima and minima in the interference pattern, $\frac{I_{max}}{I_{min}}$.

OR

Light from a point source in air falls on a spherical glass surface (n = 1.67 and radius of curvature = 25 cm). The distance of the light source from the glass surface is 95 cm. At what position the image is formed?

8. A biconvex lens has a radius of curvature of magnitude 20 cm. Which one of the following options describe best the image formed of an object of height 2 cm placed 30 cm from the lens? [μ = 3/2]

9. Identify the part of the electromagnetic spectrum which is
   (a) suitable for radar system used in aircraft navigation,
   (b) produced by bombarding a metal target by high speed electrons.

10. In a diffraction pattern due to a single slit of width a, the first minimum is observed at an angle 30° when light of wavelength 5000 Å is incident on the slit. Find the angle at which the first secondary maximum is observed.

11. (a) How are electromagnetic waves produced?
    (b) How do you convince yourself that electromagnetic waves carry energy and momentum?

SECTION - C

12. CASE STUDY : NUCLEAR FISSION

In the year 1939, German scientist Otto Hahn and Strassmann discovered that when an uranium isotope was bombarded with a neutron, it breaks into two intermediate mass fragments. It was observed that, the sum of the masses of new fragments formed were less than the mass of the original nuclei. This difference in the mass appeared as the energy released in the process. Thus, the phenomenon of splitting of a heavy nucleus (usually $A > 230$) into two or more lighter nuclei by the bombardment of proton, neutron, α-particle, etc with liberation of energy is called nuclear fission.

$$_{92}U^{235} + {}_0n^1 \rightarrow \underset{\text{Unstable nucleus}}{{}_{92}U^{236}} \rightarrow {}_{56}Ba^{144} + {}_{36}Kr^{89} + 3{}_0n^1 + Q$$

(i) Nuclear fission can be explained on the basis of

(a) Millikan's oil drop method
(b) Liquid drop model
(c) Shell model
(d) Bohr's model.

(ii) For sustaining the nuclear fission chain reaction in a sample (of small size) of $^{235}_{92}U$, it is desirable to slow down fast neutrons by

(a) friction
(b) elastic damping/scattering
(c) absorption
(d) none of these.

(ii) Which of the following is/are fission reaction(s)?

(I) $^{1}_{0}n + ^{235}_{92}U \rightarrow ^{236}_{92}U \rightarrow ^{133}_{51}Sb + ^{99}_{41}Nb + 4^{1}_{0}n$

(II) $^{1}_{0}n + ^{235}_{92}U \rightarrow ^{1.40}_{54}Xe + ^{94}_{38}Sr + 2^{1}_{0}n$

(III) $^{2}_{1}H + ^{2}_{1}H \rightarrow ^{3}_{2}He + ^{1}_{0}n$

(a) Both II and III
(b) Both I and III
(c) Only II
(d) Both I and II

(iv) On an average, the number of neutrons and the energy of a neutron released per fission of a uranium atom are respectively

(a) 2.5 and 2 keV
(b) 3 and 1 keV
(c) 2.5 and 2 MeV
(d) 2 and 2 keV

(v) In any fission process, ratio of mass of daughter nucleus to mass of parent nucleus is

(a) less than 1
(b) greater than 1
(c) equal to 1
(d) depends o the mass of parent nucleus.