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	–	–	1(5)	5(17)
9.	Unit-VI	Ray Optics and Optical Instruments	–	3(9)#	–	
10.		Wave Optics	–	1(3)#	–	
11.	Unit-VII	Dual Nature of Radiation and Matter	–	1(3)	–	4(11)
12.	Unit-VIII	Atoms	1(2)#	1(3)	–	
13.		Nuclei	–	1(3)	–	
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.

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

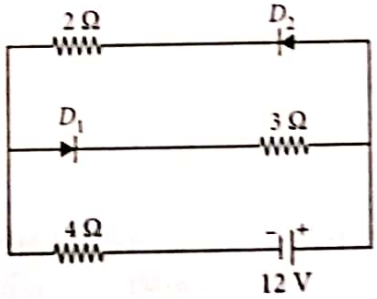
1. The current in the forward bias is known to be more (~mA) than the current in the reverse bias (~ μA). What is the reason, then, to operate the photodiode in reverse bias?

2. Calculate the orbital period of the electron in the first excited state of hydrogen atom.

OR

Define ionization energy. How would the ionization energy change when electron in hydrogen atom is replaced by a particle of mass 200 times that of the electron but having the same charge?

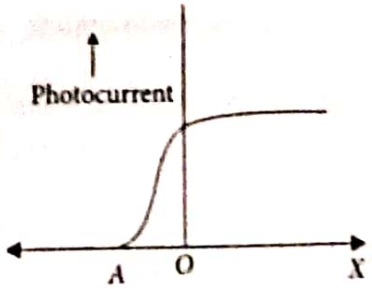
3. The circuit shown in the figure has two oppositely connected ideal diodes connected in parallel. Find the current flowing through each diode in the circuit.



SECTION - B

4. **Draw the circuit diagram of a half wave rectifier and explain its working. Also, give the input and output waveforms.**

5. **The following graph shows the variation of photocurrent for a photosensitive metal:**



(a) Identify the variable X on the horizontal axis.

(b) What does the point A on the horizontal axis represent?

(c) Draw this graph for three different values of frequencies of incident radiation υ_1, υ_2 and υ_3 ($\upsilon_1 > \upsilon_2 > \upsilon_3$) for same intensity.

(d) Draw this graph for three different values of intensities of incident radiation I_1, I_2 and I_3 ($I_1 > I_2 > I_3$) having same frequency.

6. Using Bohr's postulates, obtain the expression for the total energy of the electron in the stationary states of the hydrogen atom. Hence draw the energy level diagram showing how the line spectra corresponding to Balmer series occur due to transition between energy levels.

7. (a) How is the size of a nucleus experimentally determined? Write the relation between the radius and mass number of the nucleus. Show that the density of nucleus is independent of its mass number.

(b) The nuclear radius of $^{27}_{13}Al$ is 3.6 fermi. Find the nuclear radius of $^{64}_{29}Cu$.

8. Two wavelengths of sodium light 590 nm and 596 nm are used, in turn to study the diffraction taking place at a single slit of aperture 2×10^{-4} m. The distance between the slit and the screen is 1.5 m. Calculate the separation between the positions of the first maxima of the diffraction pattern obtained in the two cases.

9. A person can see clearly objects only when they lie between 50 cm and 400 cm from his eyes. In order to increase the maximum distance of distinct vision to infinity, person has to use what type and power of the correcting lens?

OR

In Young's double experiment, a monochromatic light of wavelength 5400 Å produces a fringe width of 3 mm. If this source is replaced by another source of monochromatic light of wavelength 6300 Å, then find the fringe width.

10. An object placed at a distance of 16 cm from a convex lens produces an image of magnification $m (m > 1)$. If the object is moved towards the lens by 8 cm then again an image of magnification m is obtained. What is the numerical value of the focal length of the lens?

11. A double convex lens is made of a glass of refractive index 1.55, with both faces of the same radius of curvature. Find the radius of curvature required, if the focal length is 20 cm.

OR

In a single slit diffraction experiment, the width of the slit is reduced to half its original width. How would this affect the size and intensity of the central maximum?

SECTION - C

12. CASE STUDY : SPEED OF AN ELECTROMAGNETIC WAVE

Maxwell showed that the speed of an electromagnetic wave depends on the permeability and permittivity of the medium through which it travels. The speed of an electromagnetic wave in free space is given by $c = \frac{1}{\sqrt{\mu_0 \varepsilon_0}}$.

The fact led Maxwell to predict that light is an electromagnetic wave. The emergence of the speed of light from purely electromagnetic considerations is the crowning achievement of Maxwell's electromagnetic theory. The speed of an electromagnetic wave in any medium of permeability μ and permittivity ε will be $\frac{c}{\sqrt{K\mu_r}}$ where K is the dielectric constant of the medium and μ_r is the relative permeability.

(i) The dimensions of $\frac{1}{2}\varepsilon_0 E^2$ (ε_0 : permittivity of free space; E = electric field) is

(a) $[MLT^{-1}]$ (b) $[ML^2T^{-2}]$ (c) $[ML^{-1}T^{-2}]$ (d) $[ML^2T^{-1}]$

(ii) Let $[\varepsilon_0]$ denote the dimensional formula of the permittivity of the vacuum. If M = mass, L = length, T = time and A = electric current, then

(a) $[\varepsilon_0] = [M^{-1}L^{-3}T^2A]$ (b) $[\varepsilon_0] = [M^{-1}L^{-3}T^4A^2]$

(c) $[\varepsilon_0] = [MLT^{-2}A^{-2}]$ (d) $[\varepsilon_0] = [ML^2T^{-1}]$

(iii) An electromagnetic wave of frequency 3 MHz passes from vacuum into a dielectric medium with permittivity $\varepsilon = 4$. Then

(a) wavelength and frequency both remain unchanged
(b) wavelength is doubled and the frequency remains unchanged
(c) wavelength is doubled and the frequency becomes half
(d) wavelength is halved and the frequency remains unchanged.

(iv) Which of the following are not electromagnetic waves?

(a) cosmic rays (b) γ-rays (c) β-rays (d) X-rays

(v) The electromagnetic waves travel with

(a) the same speed in all media
(b) the speed of light, $c = 3 \times 10^8$ m s^{-1} in free space
(c) the speed of light, $c = 3 \times 10^8$ m s^{-1} in solid medium
(d) the speed of light, $c = 3 \times 10^8$ m s^{-1} in fluid medium.