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(3)	–	5(17)
9.	Unit-VI	Ray Optics and Optical Instruments	–	2(6)	–	
10.		Wave Optics	–	1(3)#	1(5)	
11.	Unit-VII	Dual Nature of Radiation and Matter	–	1(3)*	–	4(11)
12.	Unit-VIII	Atoms	–	2(6)	–	
13.		Nuclei	1(2)*	–	–	
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.

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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. What is the function of a photodiode ?

2. Show that density of nucleus is independent of its mass number A.

OR

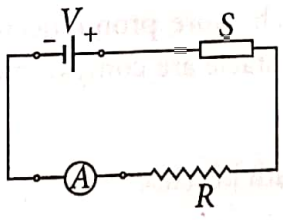
If the nuclear radius of ^{27}Al is 3.6 fermi, then find the approximate nuclear radius of ^{64}Cu in fermi.

3. The intrinsic carrier concentration of silicon sample at 300 K is 1.5×10^{16} m^{-3}. What is the density of minority carrier? (after doping, the number of majority carriers is 5×10^{20} m^{-3})

SECTION - B

4. Write the expression for the speed of light in a material medium of relative permittivity ε_r and relative magnetic permeability μ_r. Also prove that the average energy density of the oscillating electric field is equal to that of the oscillating magnetic field.

5. (a) In the following diagram 'S' is a semiconductor. Would you increase or decrease the value of R to keep the reading of the ammeter A constant when S is heated? Give reason for your answer.



(b) Draw the circuit diagram of a photodiode and explain its working. Draw its I-V characteristics.

6. (i) A ray of light incident on face AB of an equilateral glass prism, shows minimum deviation of 30°. Calculate the speed of light through the prism.

(ii) Find the angle of incidence at face AB so that the emergent ray grazes along the face AC.

7. Calculate the wavelength of H_α line in Balmer series of hydrogen atom, given Rydberg constant $R = 1.097 \times 10^7\ m^{-1}$.

8. Depict the shape of a wavefront in each of the following cases.
   (i) Light diverging from point source.
   (ii) Light emerging out of a convex lens when a point source is placed at its focus.
   (iii) Using Huygen's construction of secondary wavelets, draw a diagram showing the passage of a plane wavefront from a denser into a rarer medium.

OR

   (a) If one of two identical slits producing interference in Young's experiment is covered with glass, so that the light intensity passing through it is reduced to 50%, find the ratio of the maximum and minimum intensity of the fringe in the interference pattern.
   (b) What kind of fringes do you expect to observe if white light is used instead of monochromatic light?

9. If the wavelength of the first line of the Balmer series of hydrogen is 6561 Å, then the wavelength of the second line of the series?

10. Define power of a lens. Write its units. Deduce the relation $\frac{1}{f} = \frac{1}{f_1} + \frac{1}{f_2}$ for two thin lenses kept in contact coaxially.

11. Draw a graph showing the variation of stopping potential with frequency of incident radiation for two photosensitive materials having work functions W_1 and $W_2 (W_1 > W_2)$. Write two important conclusions that can be drawn from the study of these plots.

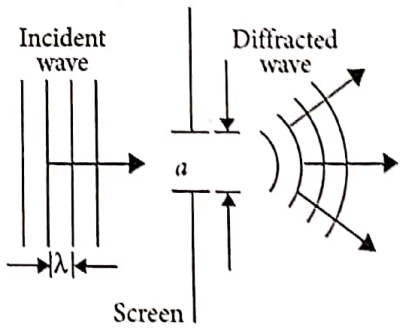
OR

Write Einstein's photoelectric equation and mention which important features in photoelectric effect can be explained with the help of this equation.
The maximum kinetic energy of the photoelectrons gets doubled when the wavelength of light incident on the surface changes from λ_1 to λ_2. Derive the expressions for the threshold wavelength λ_0 and work function for the metal surface.

SECTION - C

12. **CASE STUDY : DIFFRACTION OF LIGHT**

The phenomenon of bending of light around the sharp corners and the spreading of light within the geometrical shadow of the opaque obstacles is called diffraction of light. The light thus deviates from its linear path. The deviation becomes much more pronounced, when the dimensions of the aperture or the obstacle are comparable to the wavelength of light.



(i) Light seems to propagate in rectilinear path because
   (a) its spread is very large
   (b) its wavelength is very small
   (c) reflected from the upper surface of atmosphere
   (d) it is not absorbed by atmosphere.

(ii) In diffraction from a single slit the angular width of the central maxima does not depends on
   (a) λ of light used
   (b) width of slit
   (c) distance of slits from the screen
   (d) ratio of λ and slit width.

(iii) For a diffraction from a single slit, the intensity of the central point is
(a) infinite
(b) finite and same magnitude as the surrounding maxima
(c) finite but much larger than the surrounding maxima
(d) finite and substantially smaller than the surrounding maxima.

(iv) Magnification power of telescope increases when
(a) wavelength of light decreases
(b) wavelength of light increases
(c) focal length of eye-piece increases
(d) focal length of eye-piece decreases.

(v) In a single diffraction pattern observed on a screen placed at D metre distance from the slit of width d metre the ratio of the width of the central maxima to the width of other secondary maxima is
(a) 2 : 1
(b) 1 : 2
(c) 1 : 1
(d) 3 : 1