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)	–	6(17)
9.	Unit-VI	Ray Optics and Optical Instruments	–	2(6)#	–	
10.		Wave Optics	1(2)	2(6)#	–	
11.	Unit-VII	Dual Nature of Radiation and Matter	1(2)	1(3)	–	4(11)
12.	Unit-VIII	Atoms	–	1(3)	–	
13.		Nuclei	–	1(3)	–	
14.	Unit-IX	Semiconductor Electronics : Materials, Devices and Simple Circuits	1(2)#	–	1(5)	2(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 *Max. Marks : 35*

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

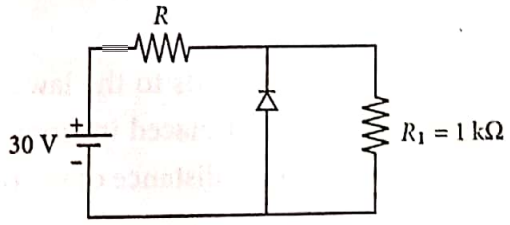
1. For a single slit of width 'a', the first minimum of the interference pattern of a monochromatic light of wavelength λ occurs at an angle of $\frac{\lambda}{a}$. At the same angle of $\frac{\lambda}{a}$, we get a maximum for two narrow slits separated by a distance 'a'. Explain.

2. An ultraviolet light of wavelength 2000 Å irradiates a photocell made of molybdenum metal. If the stopping potential is – 1.5 V, what is the work function of the metal?
(Planck's constant = 6.6×10^{-34} J s) .

3. Explain, with the help of a circuit diagram, the working of a photodiode. Write briefly how it is used to detect the optical signals.

OR

If current in diode is five times that in R_1. Breakdown voltage of diode is 6 volt. Find the value of R.



SECTION - B

4. (i) In hydrogen atom, an electron undergoes transition from 2nd excited state to the first excited state and then to the ground state. Identify the spectral series to which these transitions belong.
(ii) Find out the ratio of the wavelengths of the emitted radiations in the two cases.

5. The photoelectric threshold wavelength of silver is 3250×10^{-10} m. Find the velocity of the electron ejected from a silver surface by ultraviolet light of wavelength 2536×10^{-10} m.
[Given : $h = 4.14 \times 10^{-15}$ eV s and $c = 3 \times 10^8$ m s^{-1}]

6. (a) Which segment of electromagnetic waves has highest frequency? How are these waves produced? Give one use of these waves.

   (b) Which *e.m.* waves lie near the high frequency end of visible part of *e.m.* spectrum? Give its one use. In what way this component of light has harmful effects on humans?

7. Draw ray diagrams to show how specially designed prisms make use of total internal reflection to obtain inverted image of the object by deviating rays (i) through 90° and (ii) through 180°.

OR

A convex lens of focal length 20 cm is placed coaxially with a convex mirror of radius of curvature 20 cm. The two are kept at 15 cm from each other. A point object lies 60 cm in front of the convex lens. Draw a ray diagram to show the formation of the image by the combination. Determine the nature and position of the image formed.

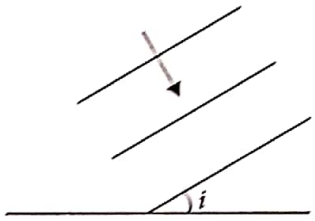
8. A slit of width *a* is illuminated by light of wavelength 6000 Å. For what value of *a* will the
   (i) First maximum fall at an angle of diffraction of 30°?
   (ii) First minimum fall at an angle of diffraction 30°?

9. The following fusion reaction takes place :

$$_1^2H + _1^2H \longrightarrow _2^3He + n + 3.27\ MeV$$

If 2 kg of deuterium is subjected to above reaction, the energy released is used to light a 100 W lamp, how long will the lamp glow?

10. A plane wavefront propagating in a medium of refractive index 'μ_1' is incident on a plane surface making the angle of incidence *i* as shown in the figure. It enters into a medium of refraction of refractive index 'μ_2' ($\mu_2 > \mu_1$). Use Huygens' construction of secondary wavelets to trace the propagation of the refracted wavefront. Hence verify Snell's law of refraction.



OR

You have learnt in the text how Huygens principle leads to the laws of reflection and refraction. Use the same principle to deduce directly that a point object placed in front of a plane mirror produces a virtual image whose distance from the mirror is equal to the distance of the object from the mirror.

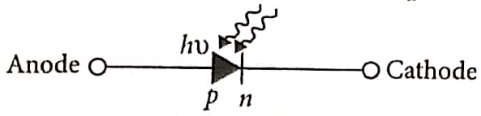
11. A glass slab of thickness 8 cm contains the same number of waves as 10 cm of water when both are traversed by the same monochromatic light. If the refractive index of water is 4/3, then find the refractive index of glass.

SECTION - C

12. CASE STUDY : PHOTODIODE

A photodiode is an optoelectronic device in which current carriers are generated by photons through photo-excitation *i.e.*, photo conduction by light. It is a *p-n* junction fabricated from a photosensitive semiconductor

and provided with a transparent window so as allow light to fall on its function. A photodiode can turn its current ON and OFF in nanoseconds. So, it can be used as a fastest photo-detector.



(i) Photodiode is a device
  (a) which is always operated in reverse bias
  (b) which of always operated in forward bias
  (c) in which photo current is independent of intensity of incident radiation
  (d) which may be operated in forward or reverse bias.

(ii) Photodiode can be used as a photodetector to detect
  (a) optical signals (b) electrical signals (c) both (a) and (b) (d) none of these

(iii) A *p-n* photodiode is fabricated from a semiconductor with a band gap of 2.5 eV. It can detect a signal of wavelength
  (a) 4000 nm (b) 6000 nm (c) 4000 Å (d) 6000 Å

(iv) Three photo diodes D_1, D_2 and D_3 are made of semiconductors having band gap of 2.5 eV, 2 eV and 3 eV, respectively. Which one will be able to detect light of wavelength 6000 Å ?
  (a) D_1 (b) D_2 (c) D_3 (d) D_1 and D_2 both

(v) To detect light of wavelength 500 nm, the photodiode must be fabricated from a semiconductor of minimum bandwidth of
  (a) 1.24 eV (b) 0.62 eV (c) 2.48 eV (d) 3.2 eV