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	–	1(3)[#]	1(5)	
10.		Wave Optics	–	2(6)[#]	–	
11.	Unit-VII	Dual Nature of Radiation and Matter	–	1(3)	–	4(11)
12.	Unit-VIII	Atoms	–	1(3)	–	
13.		Nuclei	1(2)	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.

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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. Distinguish between a metal and an insulator on the basis of energy band diagrams.

2. The density of an electron-hole pair in a pure germanium is 3×10^{16} m^{-3} at room temperature. On doping with aluminium, the hole density increases to 4.5×10^{22} m^{-3}. Find the electron density (in m^{-3}) in doped germanium.

3. How is the radius of a nucleus related to its mass number A?

OR

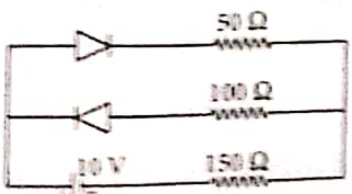
A nucleus at rest splits into two nuclear parts having radii in the ratio 1 : 3. Find the ratio of their velocities.

SECTION - B

4. The radiation corresponding to $3 \rightarrow 2$ transition of hydrogen atom falls on a metal surface to produce photoelectrons. These electrons are made to enter a magnetic field of 3×10^{-4} T. If the radius of the largest circular path followed by these electrons is 10.0 mm, calculate the work function of the metal.

5. A nucleus with mass number 184 initially at rest emits an α-particle. If the Q value of the reaction is 5.5 MeV, calculate the kinetic energy of the α-particle.

6. Assume that each diode shown in the figure has a forward bias resistance of 50 Ω and an infinite reverse bias resistance. Find the current through the resistance 150 Ω.



7. (a) A concave lens of refractive index 1.5 is immersed in a medium of refractive index 1.65. What is the nature of the lens?

(b) A screen is placed 80 cm from an object. The image of the object on the screen is formed by a convex lens placed between them at two different locations separated by a distance 20 cm. Determine the focal length of the lens.

OR

Draw a labelled ray diagram of an astronomical telescope in the near point adjustment position.

A giant refracting telescope at an observatory has an objective lens of focal length 15 m and an eyepiece of focal length 1.0 cm. If this telescope is used to view the Moon, find the diameter of the image of the Moon formed by the objective lens. The diameter of the Moon is 3.48×10^6 m, and the radius of lunar orbit is 3.8×10^8 m.

8. Sketch the graphs showing variation of stopping potential with frequency of incident radiations for two photosensitive materials A and B having threshold frequencies $\upsilon_A > \upsilon_B$.

(i) In which case is the stopping potential more and why?

(ii) Does the slope of the graph depend on the nature of the material used ? Explain.

9. The electric field part of an electromagnetic wave in a medium is represented by $E_x = 0$,

$E_y = 2.5\frac{\text{N}}{\text{C}}\cos\left[\left(2\pi\times10^6\frac{\text{rad}}{\text{m}}\right)t-\left(\pi\times10^{-2}\frac{\text{rad}}{\text{s}}\right)x\right]$, $E_z = 0$. Find the frequency of wave.

10. Explain the following, giving reasons:

(i) When monochromatic light is incident on a surface separating two media, the reflected and refracted light both have the same frequency as the incident frequency.

(ii) When light travels from a rarer to a denser medium, the speed decreases. Does this decrease in speed imply a reduction in the energy carried by the wave ?

(iii) In the wave picture of light, intensity of light is determined by the square of the amplitude of the wave. What determines the intensity in the photon picture of light?

OR

Answer the following questions :

(a) In a double slit experiment using light of wavelength 600 nm, the angular width of the fringe formed on a distant screen is 0.1°. Find the spacing between the two slits.

(b) Light of wavelength 500 Å propagating in air gets partly reflected from the surface of water. How will the wavelengths and frequencies of the reflected and refracted light be affected?

11. (a) Yellow light ($\lambda = 6000$ Å) illuminates a single slit of width 1×10^{-4} m. Calculate (i) the distance between the two dark lines on either side of the central maximum, when the diffraction pattern is viewed on a screen kept 1.5 m away from the slit; (ii) the angular spread of the first diffraction minimum.

(b) How can be the resolving power of a telescope increase?

SECTION - C

12. **CASE STUDY : REFRACTION THROUGH SPHERICAL SURFACES**

Refraction of light is the change in the path of light as it passes obliquely from one transparent medium to another medium. According to law of refraction $\frac{\sin i}{\sin r} = {}^1\mu_2$, where ${}^1\mu_2$ is called refractive index of second medium with respect to first medium. From refraction at a convex spherical surface, we have

$\frac{\mu_2}{v}-\frac{\mu_1}{u}=\frac{\mu_2-\mu_1}{R}$. Similarly from refraction at a concave spherical surface when object lies in the rarer medium, we have $\frac{\mu_2}{v}-\frac{\mu_1}{u}=\frac{\mu_2-\mu_1}{R}$ and when object lies in the denser medium, we have $\frac{\mu_1}{v}-\frac{\mu_2}{u}=\frac{\mu_1-\mu_2}{R}$.

(i) Refractive index of a medium depends upon

(a) nature of the medium
(b) wavelength of the light used
(c) temperature
(d) all of these

(ii) A ray of light of frequency 5×10^{14} Hz is passed through a liquid. The wavelength of light measured inside the liquid is found to be 450×10^{-9} m. The refractive index of the liquid is

(a) 1.33
(b) 2.52
(c) 2.22
(d) 0.75

(iii) A ray of light is incident at an angle of 60° on one face of a rectangular glass slab of refractive index 1.5. The angle of refraction is

(a) $\sin^{-1}(0.95)$
(b) $\sin^{-1}(0.58)$
(c) $\sin^{-1}(0.79)$
(d) $\sin^{-1}(0.86)$

(iv) A point object is placed at the centre of a glass sphere of radius 6 cm and refractive index 1.5. The distance of the virtual image from the surface of sphere is

(a) 2 cm
(b) 4 cm
(c) 6 cm
(d) 12 cm

(v) In refraction, light waves are bent on passing from one medium to the second medium because in the second medium

(a) the frequency is different
(b) the co-efficient of elasticity is different
(c) the speed is different
(d) the amplitude is smaller.