TERM-II

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

Subject Code : 042

PHYSICS

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. (a) Mention the important considerations required while fabricating a *p-n* junction diode to be used as a light emitting diode (LED).

(b) What should be the order of band gap of an LED if it is required to emit light in the visible range?

2. A beam of light converges at a point *P*. Now a convex lens is placed in the path of the convergent beam at 15 cm from point *P*. At what point does a beam converge if the convex lens has a focal length 10 cm ?

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

OR

Draw a plot showing the variation of resistivity of a (i) conductor and (ii) semiconductor, with the increase in temperature.

SECTION - B

4. (a) Three photo diodes D_1, D_2 and D_3 are made of semiconductors having band gaps of 2.5 eV, 2 eV and 3 eV respectively. Which of them will not be able to detect light of wavelength 500 nm ?

(b) Why photodiodes are required to operate in reverse bias ? Explain.

5. (a) Complete the following nuclear reactions:

(i) $^{208}_{84}\text{Po} \rightarrow ^{204}_{82}\text{Pb} + ...$ (ii) $^{32}_{15}\text{P} \rightarrow ^{32}_{16}\text{S} + ...$

(b) Write the basic process involved in nuclei responsible for (i) β^- and (ii) β^+ decay.

(c) Why is it found experimentally difficult to detect neutrinos?

6. In a typical nuclear reaction, *e.g.*

$^{2}_{1}\text{H} + ^{2}_{1}\text{H} \rightarrow ^{3}_{2}\text{He} + ^{1}_{0}n + 3.27 \text{ MeV}$,

although number of nucleons is conserved, yet energy is released. How? Explain.

7. A convex lens made up of glass of refractive index 1.5 is dipped, in turn, in (i) a medium of refractive index 1.65, (ii) a medium of refractive index 1.33.

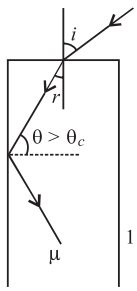
(a) Will it behave as a converging or a diverging lens in the two cases?

(b) How will its focal length change in the two media?

OR

Two slits are made one millimetre apart and the screen is placed one metre away. What is the fringe separation when blue-green light of wavelength 500 nm is used?

8. In the figure shown for an angle of incidence i at the top of the surface, what is the minimum refractive index for total internal reflection at the vertical surface?

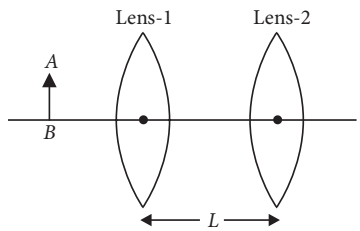


9. In a double slit experiment, the distance between slits is 5.0 mm and the slits are 1.0 m from the screen. Two interference patterns can be seen on the screen : one due to light of wavelength 480 nm and the other due to light of wavelength 600 nm. What is the separation on the screen between the third order bright fringes of the two interference patterns?

OR

In a *YDSE*, the slits are 2 mm apart and are illuminated with a mixture of two wavelengths $\lambda = 750$ nm and $\lambda' = 900$ nm. At what distance from the common central bright fringe on a screen 2 m from the slits will a bright fringe from one interference pattern coincide with a bright fringe from the other?

10. Figure shows an object AB placed in front of two thin coaxial lenses 1 and 2 with focal lengths 24 cm and 9.0 cm, respectively. The object is 6.0 cm from the lens 1 and the lens separation is $L = 10$ cm. Where does the system of two lenses produce an image of the object AB ?



11. (a) Arrange the following electromagnetic waves in the descending order of their wavelengths :

(i) Microwaves

(ii) Infra-red rays

(iii) Ultra-violet-radiation

(iv) Gamma rays

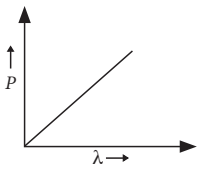
(b) Write one use each of any two of them.

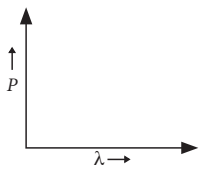
SECTION - C

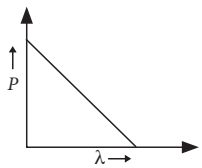
12. CASE STUDY : PHOTOELECTRIC EFFECT

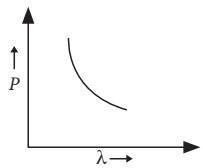
According to Einstein, when a photon of light of frequency υ or wavelength λ is incident on a photosensitive metal surface of work function ϕ_0, where $\phi_0 < h\upsilon$ (here, h is Planck's constant), then the emission of photoelectrons takes place. The maximum kinetic energy of the emitted photoelectrons is given by $K_{max} = h\upsilon - \phi_0$. If the frequency of the incident light is υ_0 called thresold frequency, the photoelectrons are emitted from metal without any kinetic energy. So $h\upsilon_0 = \phi_0$.

(i) Which of the following figures represent the variation of particle momentum and the associated de-Broglie wavelength?

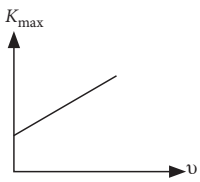
(a) 

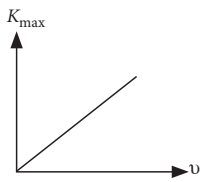
(b) 

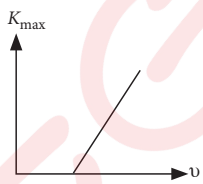
(c) 

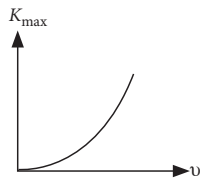
(d) 

(ii) The variation of maximum kinetic energy (K_{max}) of the emitted photoelectrons with frequency (υ) of the incident radiations can be represented by

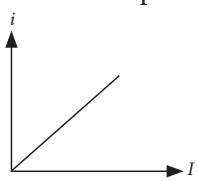
(a) 

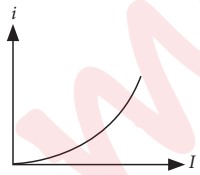
(b) 

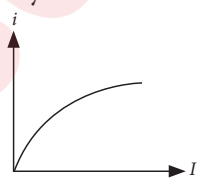
(c) 

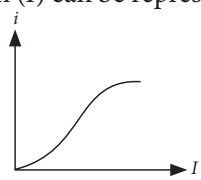
(d) 

(iii) The variation of photoelectric current (i) with the intensity of the incident radiation (I) can be represented by

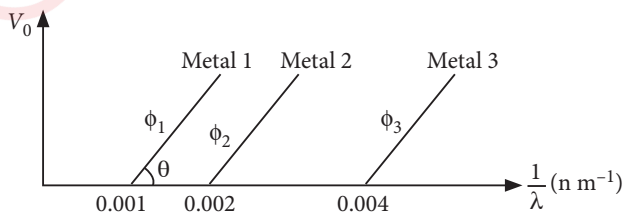
(a) 

(b) 

(c) 

(d) 

(iv) The graph between the stopping potential (V_0) and $\left(\frac{1}{\lambda}\right)$ is shown in the figure. ϕ_1, ϕ_2, ϕ_3 are work function. Which of the following options is correct?



(a) $\phi_1 : \phi_2 : \phi_3 = 1 : 2 : 3$

(b) $\phi_1 : \phi_2 : \phi_3 = 4 : 2 : 1$

(c) $\phi_1 : \phi_2 : \phi_3 = 1 : 2 : 4$

(d) Ultraviolet light can be used to emit photoelectrons from metal 2 and metal 3 only.

(v) A metal of work function 3·3 eV is illuminated by light of wavelength 300 nm. The maximum kinetic energy of photoelectrons emitted is (taking $h = 6{\cdot}6 \times 10^{-34}$ J s)

(a) 0·413 eV (b) 0·825 eV (c) 1·65 eV (d) 1·32 eV