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)*	1(5)	
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.

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.

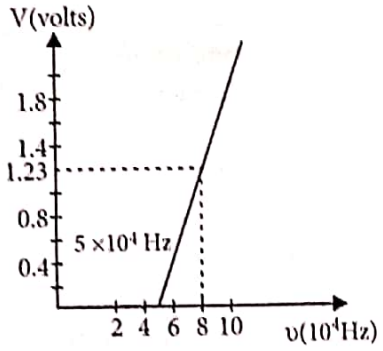
SECTION - A

1. Draw energy band diagrams of an n-type and p-type semiconductor at temperature $T > 0$ K. Mark the donor and acceptor energy levels with their energies.

2. A small particle of mass m moves in such a way that the potential energy $U = ar^2$ where a is a constant and r is the distance of the particle from the origin. Assuming Bohr's model of quantisation of angular momentum for circular orbits, find the radius of n^{th} allowed orbit.

OR

Using the graph shown in the figure for stopping potential versus the incident frequency of photons, calculate Planck's constant.



3. Sketch V-I characteristic and mention it significance of solar cell.

SECTION - B

4. The electron in a given Bohr orbit has a total energy of –1.5 eV. Calculate its
   (i) kinetic energy
   (ii) potential energy
   (iii) wavelength of radiation emitted, when this electron makes a transition to the ground state.
   [Given : Energy in the ground state = –13.6 eV and Rydberg's constant = 1.09×10^7 m^{-1}]

5. A student wants to use two p-n junction diodes to convert alternating current into direct current. Draw the labelled circuit diagram she would use and explain how it works.

6. Calculate the energy in fusion reaction : ${}_1^2H + {}_1^2H \rightarrow {}_2^3He + n$, where B.E. of ${}_1^2H$ = 2.23 MeV and of ${}_2^3He$ = 7.73 MeV.

7. Define the term, "refractive index" of a medium. Verify Snell's law of refraction when a plane wavefront is propagating from a denser to a rarer medium.

8. (a) Draw a ray diagram for the formation of image by a compound microscope.
   (b) You are given the following three lenses. Which two lenses will you use as an eyepiece and as an objective to construct a compound microscope?

Lenses	Power (D)	Aperture (cm)
L_1	3	8
L_2	6	1
L_3	10	1

OR

   (a) Draw a schematic labelled ray diagram of a reflecting type telescope.
   (b) Write two important advantage justifying why reflecting type telescopes are preferred over refracting type telescopes.
   (c) The objective of a telescope is of larger focal length and of larger aperture (compared to the eyepiece). Why? Give reasons.

9. (a) State two important features of Einstein's photoelectric equation.
   (b) Radiation of frequency 10^{15} Hz is incident on two photosensitive surfaces P and Q. There is no photoemission from surface P. Photoemission occurs from surface Q but photoelectrons have zero kinetic energy. Explain these observations and find the value of work function for surface Q.

10. The image of an object, formed by a plano-convex lens at a distance of 8 m behind the lens, is real and is one-third the size of the object. The wavelength of light inside the lens is $\frac{2}{3}$ times the wavelength in free space. Find the radius of the curved surface of the lens.

11. (a) Identify the part of the electromagnetic spectrum used in (i) radar and (ii) eye surgery. Write their frequency range.
   (b) Express the velocity of propagation of an *e.m.* wave in terms of the peak value of the electric and magnetic fields.

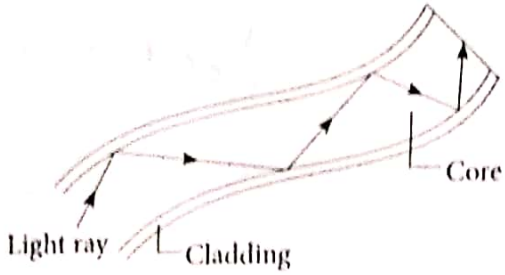
OR

   (a) Two monochromatic waves emanating from two coherent sources have the displacements represented by $y_1 = a \cos \omega t$ and $y_2 = a \cos(\omega t + \phi)$
   where ϕ is the phase difference between the two displacements. Show that the resultant amplitude at a point due to their superposition is given by $A^2 = 4a^2 \cos^2(\phi/2)$.
   (b) Hence obtain the conditions for constructive and destructive interference.

SECTION - C

12. CASE STUDY : OPTICAL FIBRES

An optical fibre is a thin tube of transparent material that allows light to pass through, without being refracted into the air or another external medium. It make use of total internal reflection. These fibres are fabricated in such a way that light reflected at one side of the inner surface strikes the other at an angle larger than critical angle. Even, if fibre is bent, light can easily travel along the length.

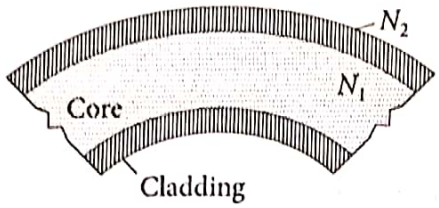


(i) Which of the following is based on the phenomenon of total internal reflection of light?
(a) Sparkling of diamond (b) Optical fibre communication
(c) Instrument used by doctors for endoscopy (d) All of these

(ii) A ray of light will undergo total internal reflection inside the optical fibre, if it
(a) goes from rarer medium to denser medium
(b) is incident at an angle less than the critical angle
(c) strikes the interface normally
(d) is incident at an angle greater than the critical angle.

(iii) If in core, angle of incidence is equal to critical angle, then angle of refraction will be
(a) 0° (b) 45° (c) 90° (d) 180°

(iv) In an optical fibre (shown), correct relation for refractive indices of core and cladding is



(a) $n_1 = n_2$ (b) $n_1 > n_2$ (c) $n_1 < n_2$ (d) $n_1 + n_2 = 2$

(v) If the value of critical angle is 30° for total internal reflection from given optical fibre, then speed of light in that fibre is
(a) 3×10^8 m s^{-1} (b) 1.5×10^8 m s^{-1} (c) 6×10^8 m s^{-1} (d) 4.5×10^8 m s^{-1}