SAMPLE QUESTION PAPER

BLUE PRINT

Time : 2 Hours **Max. Marks :** 35

S. No.						
		Electromagnetic Waves	–	1(3)#	1(5)	
8.	Unit-V	Ray Optics and Optical Instruments	–	2(6)	–	5(17)
9.	Unit-VI	Wave Optics	–	1(3)*	–	
10.		Dual Nature of Radiation and Matter	–	1(3)	–	
11.	Unit-VII	Atoms	1(2)#	1(3)	–	4(11)
12.	Unit-VIII	Nuclei	–	1(3)	–	
13.		Semiconductor Electronics : Materials, Devices and Simple Circuits	2(4)	1(3)	–	3(7)
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.

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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.

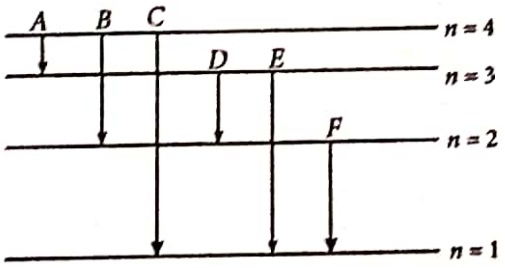
SECTION - A

1. How does a light emitting diode (LED) work? Give two advantages of LED's over the conventional incandescent lamps.

2. In an experiment on α–particle scattering by a thin foil of gold, draw a graph showing, the number of particles scattered versus the scattering angle θ. Why is it that a very small fraction of the particles are scattered at $\theta > 90°$? Write two important conclusions that can be drawn regarding the structure of the atom from the study of this experiment.

OR

The figure shows energy level diagram of hydrogen atom.



(a) Find out the transition which results in the emission of a photon of wavelength 496 nm.

(b) Which transition corresponds to the emission of radiation of maximum wavelength? Justify your answer.

3. Distinguish between 'intrinsic' and 'extrinsic' semiconductors.

SECTION - B

4. Write the two processes that take place in the formation of a *p-n* junction. Explain with the help of a diagram, the formation of depletion region and barrier potential in a *p-n* junction.

5. The maximum kinetic energy of the photoelectrons emitted is doubled when the wavelength of light incident on the photosensitive surface changes from λ_1 to λ_2. Deduce expressions for the threshold wavelength and work function for the metal surface in terms of λ_1 and λ_2.

6. Calculate for how many years will the fusion of 2.0 kg deuterium keep 800 W electric lamp glowing. Take the fusion reaction as

$${}_1^2H + {}_1^2H \longrightarrow {}_2^3He + {}_0^1n + 3.27 \text{ MeV}$$

7. The electric field of an electromagnetic wave in free space is given by $\vec{E} = 10\cos(10^7 t + kx)\hat{j}$ V/m, where t and x are in seconds and metres respectively. Find the wavelength λ and wave number k?

OR

The magnetic component of a wave of light is $B_x = (4.0 \times 10^{-6}\text{ T}) \sin[(1.57 \times 10^7\text{ m}^{-1})\, y + \omega t]$
Find the intensity of light.

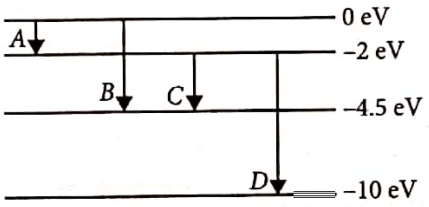
8. Dictate the phenomenon of total internal reflection applied in cable fibre optics.

9. Deduce, with the help of Young's arrangement to produce interference pattern and an expression for the fringe width.

OR

Using Huygens principle, obtain the law of refraction at a plane interface when light passes from a rarer to a denser medium.

10. The energy levels of a hypothetical atom are shown in the given figure. Which of the shown transitions will result in the emission of a photon of wavelength 275 nm?
Which of these transitions correspond to emission of radiation of (i) maximum and (ii) minimum wavelength?



11. Two similar thin equi-convex lenses, of focal length f each, are kept coaxially in contact with each other such that the focal length of the combination is F_1. When the space between the two lenses is filled with glycerin (which has the same refractive index ($\mu = 1.5$) as that of glass) then the equivalent focal length is F_2. Find the ratio of F_1 and F_2.

SECTION - C

12. CASE STUDY : ELECTROMAGNETIC SPECTRUM

All the known radiations from a big family of electromagnetic waves which stretch over a large range of wavelengths. Electromagnetic wave include radio waves, microwaves, visible light waves, infrared rays, UV rays, X-rays and gamma rays. The orderly distribution of the electromagnetic waves in accordance with their wavelength or frequency into distinct groups having widely differing properties is electromagnetic spectrum.

(i) Which wavelength of the Sun is used finally as electric energy?

(a) Radio waves
(b) Infrared waves
(c) Visible light
(d) Microwaves

(ii) Which of the following electromagnetic radiations have the longest wavelength?

(a) X-rays
(b) γ-rays
(c) Microwaves
(d) Radiowaves

(iii) Which one of the following is not electromagnetic in nature?

(a) X-rays
(b) Gamma rays
(c) Cathode rays
(d) Infrared rays

(iv) Which of the following has minimum wavelength ?

(a) X-rays
(b) Ultraviolet rays
(c) γ-rays
(d) Cosmic rays

(v) The decreasing order of wavelength of infrared, microwave, ultraviolet and gamma rays is

(a) microwave, infrared, ultraviolet, gamma rays
(b) gamma rays, ultraviolet, infrared, microwave
(c) microwave, gamma rays, infrared, ultraviolet
(d) infrared, microwave, ultraviolet, gamma rays.