EEE CONSORTIUM
PREBOARD EXAMINATION (2021-22)

Subject: PHYSICS   **Max. Marks:35**

Grade: 12   **Time: 2 hours**

Name: **Section:**   **Roll No:**

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

All questions are compulsory. In case of internal choices, attempt any one of them.

1. What is meant by depletion region in a junction diode? How is the region formed?   2

2. Show the graphical variation of (i) photoelectric current vs. anode potential keeping the intensity same and (ii) kinetic energy of the photoelectrons vs. frequency.   2

OR

Consider two different hydrogen atoms. The electron in each atom is in an excited state. Is it possible for the electrons to have different energies but same orbital angular momentum according to the Bohr model? Justify your answer.

3. Draw the circuit diagram of a full wave rectifier. Give its input and out put wave forms   2

Section – B

4. The energy levels of an atom are shown in figure.   3

   a) Which of them will result in the emission of a photon of wavelength 275 nm?
   b) Which transition corresponds to emission of radiation of maximum and minimum wavelength?
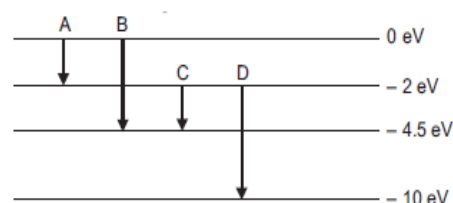
5. a) The graph shows the V-I characteristics of a semiconductor device X. Identify the device X   3
    b) Why is this device connected in reverse bias?
    c) Write the processes involved when this devise is connected to a battery in reverse bias?
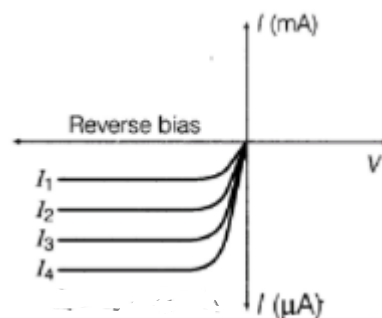
6. a) Show that nuclear density in a given nucleus is independent of mass number A.   3
    b) Calculate the binding energy of a nitrogen nucleus (N_7^{14}) from the following data in Mev.
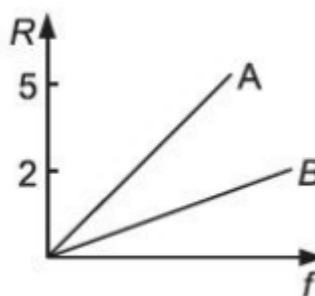 $m_H=1.00783u$, $m_n=1.00867u$, $m_N=14.00307u$

7. Show by diagram how does the shape of a plane wave front change after passing through a convex lens. Using Huygen's principle of wave propagation, prove Snell's law of refraction for light moving from denser to rarer medium.   3

8. A diverging lens of focal length 'F' is cut into two identical parts each forming a plano-concave lens. What is the focal length of each part ?   3
    Figure shows an object AB placed in front of two thin coaxial lenses 1 and 2 with focal lengths 24 cm and 9 cm respectively. The object is 6 cm from lens 1 and the lens separation is L=10 cm. Where does the system of two lenses produces an image of the object AB?
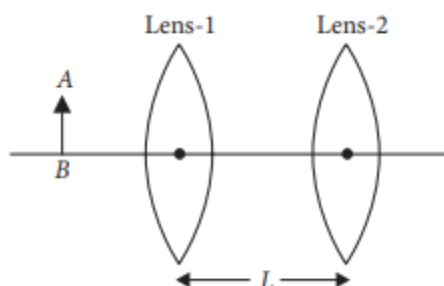
OR

Focal length (f) versus radius of curvature (R) of the faces for two double convex lenses A and B with both faces of equal radii of curvature is shown in the figure.
    a) Which of them has larger focal length for the same value of R?
    b) Which of them has greater value of refractive index in air and why?

9. Plot a graph showing variation of de Broglie wavelength (λ) associated with a charged particle of mass m, versus $1/\sqrt{V}$, where V is the potential difference through which the particle is accelerated. How does this graph give us the information regarding the magnitude of the charge of the particle?   3

10. a) Explain with reason, how the power of a diverging lens changes when it is kept in a medium of refractive index greater than that of the lens.   3

b) A compound microscope has an objective of focal length 1.25 cm and eyepiece of focal length 5 cm. A small object is kept at 2.5 cm from the objective. If the final image formed is at infinity, find the distance between the objective and the eyepiece?

11   a)   Name the e.m. waves which are–   3
         (i)   Suitable for radar systems used in aircraft navigation.
         (ii) Used to treat muscular pain
         (iii)Used as a diagnostic tool in medicine.
     b)   Write in brief how these waves are produced

OR

What is the effect on the interference pattern observed in a Young's double-slit experiment in the following cases:
   (i)   screen is moved away from the plane of the slits,
        (ii)   separation between the slits is increased,
        (iii)   width of the slits are doubled. Give reason for your answers.

Section – C

12   **CASE STUDY ON OPTIC FIBRES**   5
Now-a-days optical fibres are extensively used for transmitting audio and video signals through long distances. Optical fibres are fabricated with high quality composite glass/quartz fibres. Each fibre consists of a core and cladding. When a signal in the form of light is directed at one end of the fibre at a suitable angle, it undergoes repeated total internal reflections along the length of the fibre and finally comes out at the other end.
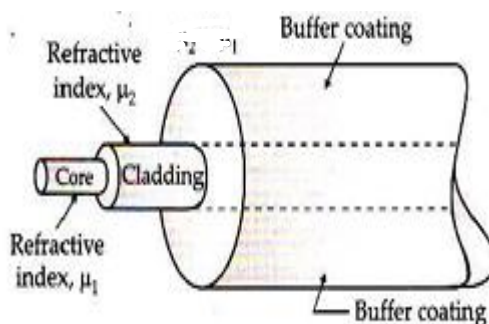

 (i)   Which of the following statement is not true.
         (a) Optical fibres is based on the principle of total internal reflection.
         (b) The refractive index of the material of the core is less than that of the cladding.
         (c) an optical fibre can be used to act as an optical pipe.
         (d)   there is no appreciable loss in the intensity of the light signal while propagating through an optical fibre.

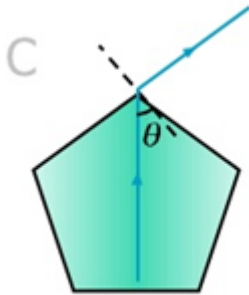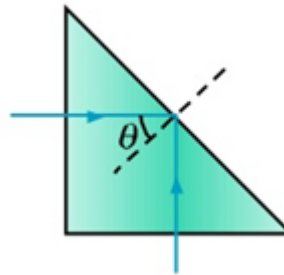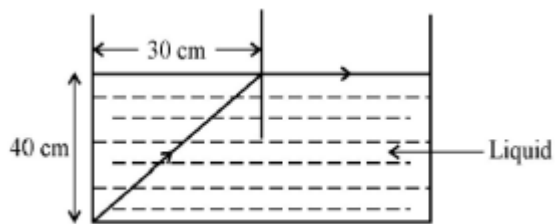(ii) Which of the following angle is the critical angle for glass

(a)
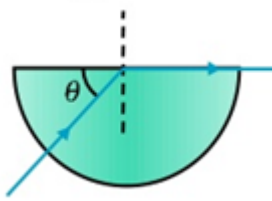
(b)
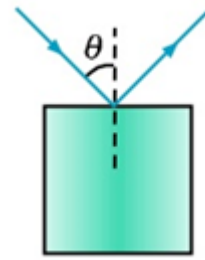
(c)

(d)

(iii) In the given figure, calculate thr speed of light in the liquid of unknown refractive index?

(a)	1.2×10^8 m/s	(b)	1.4×10^8 m/s
(c)	1.6×10^8 m/s	(d)	1.8×10^8 m/s

(iv) In an optical fibre, if μ_1 and μ_2 are the refractive indices of the core and cladding, then which among the following, would be a correct equation?

(a)	$\mu_1 < \mu_2$	(b)	$\mu_1 = \mu_2$
(c)	$\mu_1 \ll \mu_2$	(d)	$\mu_1 > \mu_2$

(v) A fish looking up through the water sees the outside world contained in a circular horizon. If the refractive index of water is 4/3 and the fish is 12cm below the surface, the radius of the circle in cm is

(a)	$36/\sqrt{7}$	(b)	$36\sqrt{7}$
(c)	$36/\sqrt{5}$	(d)	$36\sqrt{5}$

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