ISC SEMESTER 2 EXAMINATION
SAMPLE PAPER - 3
PHYSICS PAPER 1 (THEORY)

Maximum Marks: 35

Time allowed: One and a half hour

*Candidates are allowed an additional **10 minutes** for **only** reading the paper.*

*They must **NOT** start writing during this time.*

***All questions are compulsory**.*

*This question paper is divided in **3 Sections A, B** and **C***

All working, including rough work, should be done on the same sheet as and adjacent to the rest of the answer.

Answers to sub parts of the same question must be given in one place only.
A list of useful physical constants is given at the end of this paper.

A simple scientific calculator without a programmable memory may be used for calculations.

Section-A

Question 1.

(i) What are the applications of $p - n$ Junction diode?

(ii) Calculate the de-Broglie wavelength of a proton of kinetic energy 500 eV. The mass of proton is 1.67×10^{-27} kg.

(iii) What is the magnitude of the potential across a Si $p - n$ Junction?

(iv) A beam of electrons is used in Young's double slit experiment. If the speed of electrons is increased then the fringe width will :

(a) increase
(b) decrease
(c) remains same
(d) fringes will not be seen

(v) A double convex lense of glass ($n = 1.5$) has a focal length of 10 cm in air. When immersed in a liquid of refractive index 3.0, the lens will behave as :

(a) converging lens of focal length 10 cm.
(b) converging lens of focal length 30 cm.
(c) diverging lens of focal length 10 cm.
(d) converging lens of focal length $\frac{10}{3}$ cm.

(vi) A hydrogen atom (ionisation potential 13.6 V) makes a transition from third excited state to second excited state. The energy of the photon emitted in the process is:

(a) 0.66 eV
(b) 2.55 eV
(c) 12.09 eV
(d) 12.75 eV

(vii) The wevelength of de-Broglie waves associated with a moving particle is independent of its:

(a) velocity
(b) charge
(c) momentum
(d) mass

Section-B

Question 2.

(i) State one assumption made in deriving the formula $\frac{n_2}{v} - \frac{n_1}{u} = \frac{n_2 - n_1}{R}$ for refraction at a spherical interface.

(ii) Can the optical centre of a lens be situated outside the lens?

Question 3.

(i) Light of wevelength 5100 Å from a narrow slit is incident an a double slit. It the overall separation of 10 fringes on a screen 0.2m away is 2×10^{-2} m, find the slit separation.

OR

(ii) State one similarity and one difference between interference and diffraction of light.

Question 4.

(i) What is the angle of refraction made by a ray of light inside a regular (that is, an equilateral) glass prism in the minimum deviation case?

(ii) State one condition for observing a sustained interference of light.

Question 5.

Distinguish between intrinsic and extrinsic semiconductors.

Question 6.

(i) The threshold wavelength for tungsten is 2400 Å. When tungsten is illuminated with light of wavelength 1600 Å, find : (a) work function, (b) maximum kinetic energy of emitted electrons.

OR

(ii) Monochromatic light of wavelength 198 nm is incident on the surface of a metallic cathode, whose work function is 2.5 eV. How much potential difference must be applied between the cathode and the anode of a photocell to just stop the photo-current from flowing?

Section-C

Question 7.

(i) Laser light of wevelength 720 mm is incident on a pair of slits which are separated by 1.8 mm. If the screen is kept 100 cm away from the two slits. Calculate.

(a) Fringe separation (fringe-with).

(b) Distance of 10^{th} bright fringe from the centre of the interference pattern.

OR

(ii) Draw a labelled ray diagram showing the formation of an image by a refracting telescope when the final image lies at infinity.

Question 8.

A compound microscope consists of two convex lenses having focal length of 1·5 cm and 5 cm. When an object is kept at a distance of 1·6 cm from the objective, the final image is virtual and lies at a distance of 25 cm from the eyepiece. Calculate magnifying power of the compound microscope in this set-up.

Question 9.

The refractive indices of silicate flint glass for wavelength 400 nm and 700 nm are 1.66 and 1.61 respectively. Find the minimum angle of deviation of an equilateral prism made of this glass for light of wavelength 400 nm and 700 nm.

Question 10.

What do you mean by the distance of the closest approach of an α-particle in Rutherford experiment ? Derive its expression.

Question 11.

Read the passage given below and answer the questions that follow.

A neutron is absorbed by a $_3Li^6$ nucleus with subsequent emission of an α-particle. Alpha (α) particles are composite particles consisting of two protons and two neutron highly bound together.

Given:

$m(_0n^1) = 1.00865\ u$

$m(_3Li^6) = 6.015126\ u$

$m(_2He^4) = 4.002603\ u$

$m(_1H^3) = 3.016049$ u

$1\ u \times c^2 = 931.5$ MeV

(i) Write the corresponding nuclear reaction.

(ii) Calculate the energy released in the reaction.

Question 12.

(i) Distinguish between *n*-type and *p*-type semiconductors.

OR

(ii) Draw the circuit diagram of a full wave rectifier. Draw the input and output wave forms.