

Ramakrishna Mission Residential College (Autonomous)
Affiliated to the University of Calcutta
Narendrapur, Kolkata 700103, West Bengal, India

UG Admission Test, 2017
Subject: Physics

Full Marks : 50

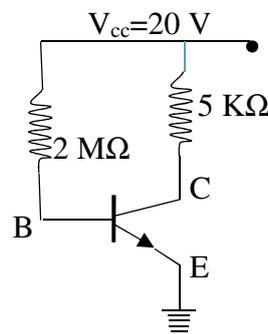
Duration : 1 hour 30 minutes

Answer all questions, use the space provided for each.
Do necessary rough works at the end of the booklet.
(Calculator not allowed)

1. Solve the following problems :

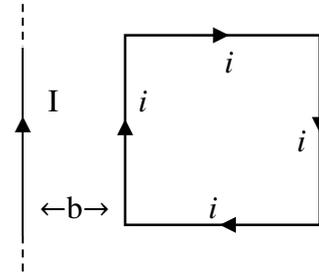
5×5=25

- a) Find the value of V_{CE} of the transistor given below. The value of V_{BE} and current gain (β) is 0.7 volt and 100 respectively.



- b) Maximum kinetic energy of photo electron is E when light of wave length λ falls on them. What will be the wave length of incident light when maximum kinetic energy of photo electron reduces to half of its previous value, i.e., $E/2$?
- c) An object is placed 21 cm in front of a concave mirror of radius of curvature 10 cm. A glass slab of thickness 3 cm and $\mu=1.50$ is then placed close to the mirror in the space between the object and the mirror. If the distance of the near surface of the slab from the mirror is 1 cm, then what will be the position of the final image ?
- d) An infinite number of charges, each of magnitude q but alternatively positive and negative are placed at a distance 1, 2, 4, 8, 16 meters from point O along the same straight line. What will be the potential and field at point O ?
- e) A liquid is kept in a cylindrical vessel which is being rotated about its axis. The liquid rises at the sides. If the radius of the vessel is 0.05 m and speed of rotation 2 rps, find the difference in height of the liquid at the center of the vessel and its sides. Take $g = 10 \text{ m/s}^2$ and $\pi^2 = 10$.
2. Solve the following problems 3×5=15
- a) A planet is revolving around the sun in an elliptical orbit. Its closest distance from the sun is R_{\min} and farthest distance is R_{\max} . If the orbital angular velocity of the planet when it is nearest to the sun is ω , then what will be the angular velocity at the farthest point from the sun ?
- b) A particle performs simple harmonic motion with amplitude A . Its speed is trebled (three times) at the instant at a distance $2A/3$ from equilibrium position. What will be the new amplitude of motion ?

- c) In a double slit experiment when a glass plate (refractive index 1.5) of thickness t is introduced in the path of one of the interfering beams (wavelength λ) intensity at the position where the central maxima occurred previously remains unchanged. What will be the thickness of glass plate in terms of λ ?
- d) A square loop (side of length a) carrying a current i is situated near a long straight wire parallel to the one of the sides of the loop at a distance b from the loop and is in the plane of the loop. A steady current I is established in the wire as shown below. What will be the force between wire and the loop ?

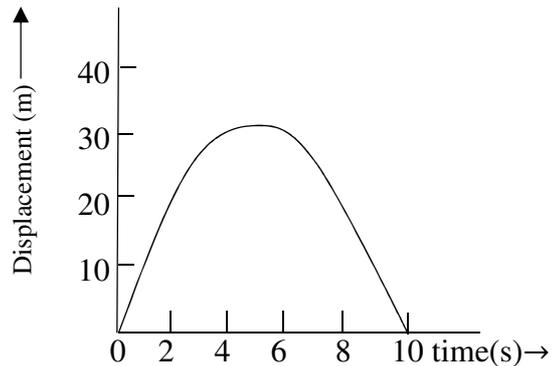


- e) The pressure of an ideal gas varies with its temperature as $P \propto T^{8/3}$. Find the value of ratio of two specific heats of the gas.

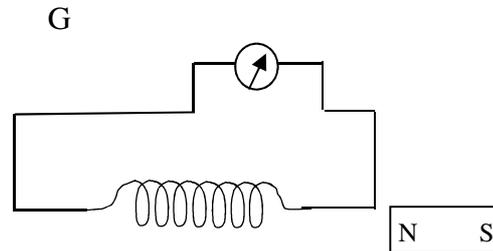
3. Draw the graph as directed :

$$2.5 \times 2 = 5$$

- a) The displacement—time graph of a moving object is shown below. Draw the velocity-time graph.



- b) A short bar magnet passes (see diagram) at a steady rate through a long solenoid. A galvanometer connected with the solenoid. Draw the graph showing variation of deflection of galvanometer with time.



4. Draw the following circuit diagram :

$$2.5 \times 2 = 5$$

- a) A full wave rectifier, using two semiconductor diodes. (Indicate the output voltage).
- b) Determination of unknown emf by a potentiometer (having total length of the potentiometer wire L) using a known emf E and a standard resistance box (R).
