



2018 VI 08

1430

Seat No. :

--	--	--	--	--

Time : 2½ Hours

PHYSICS (Old Pattern)

Subject Code

H	7	0	2
---	---	---	---

Total No. of Questions : 5

(Printed Pages : 7)

Maximum Marks : 55

- INSTRUCTIONS :**
- All questions are compulsory.**
  - Answers to the multiple choice questions should be written by choosing and writing the correct alternative.
  - There is no overall choice. However internal choice has been provided in **two** questions of four marks **each** and **one** question of **three** marks.
  - Use** of calculators is **not** permitted. **However**, you may ask for mathematical tables.
  - You may use the following values of **physical constants wherever necessary :**

**Constants :**

$$c = 3 \times 10^8 \text{ m/s}$$

$$e = 1.6 \times 10^{-19} \text{ C}$$

$$h = 6.6 \times 10^{-34} \text{ Js}$$

$$m_e = 9.1 \times 10^{-31} \text{ kg}$$

$$\mu_0 = 4\pi \times 10^{-7} \text{ TmA}^{-1}$$

$$\frac{1}{4\pi\epsilon_0} = 9 \times 10^9 \text{ Nm}^2\text{C}^{-2}$$

$$\pi = 3.14$$

$$\epsilon_0 = 8.85 \times 10^{-12} \text{ C}^2/\text{Nm}^2.$$

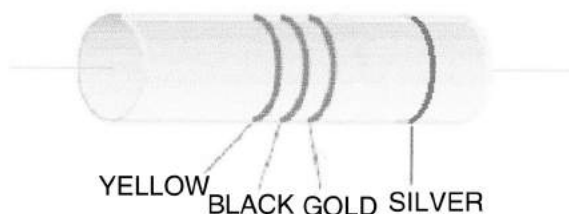
1. A) Magnification at the least distance of distinct vision of a simple microscope of focal length 5 cm is

[1]

- 3
- 4
- 5
- 6

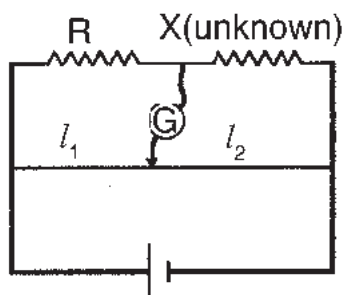


- B) When monochromatic light is incident on a surface separating two media, the reflected and refracted light both have the same frequency as the incident frequency. Why ? [1]
- C) Which part of the electromagnetic spectrum is used in the following cases : [2]
- i) Remote switches in household electronic systems.
  - ii) Treating unpurified water for germs.
- D) Obtain the expression for the torque acting on a rectangular coil carrying current when placed in a uniform magnetic field. [2]
- E) Two circular coils X and Y, having the same number of turns but with radii 10 cm and 5 cm respectively are placed in the horizontal plane with their centre's coinciding with each other. Coil X has a current 3 A flowing through it in the clockwise sense. Calculate the current that has to flow in coil Y to make the total magnetic field at the common centre of the two coils, zero. [2]
- F) A carbon resistor has the following colour bands on it. [3]



What is the value of the resistor ? What is its tolerance ? Why are carbon resistors preferred in most electronic circuits ?

2. A) In a Meter Bridge experiment, null point for an unknown carbon resistance 'X' is measured. Now, the unknown resistance 'X' is put inside an enclosure maintained at a higher temperature. The null point can be obtained at the same point as before by [1]

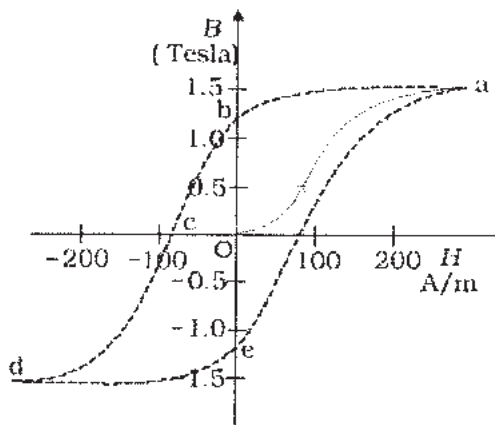


- Decreasing the value of resistance R, since the resistance of X increases



- Decreasing the value of resistance  $R$ , since the resistance of  $X$  decreases.
- Increasing the value of resistance  $R$ , since the resistance of  $X$  increases
- Increasing the value of resistance  $R$ , since the resistance of  $X$  decreases.

- B) Why are sharp points used as electrodes in the Van de Graaff generator ? [1]
- C) Write Einstein's photoelectric equation. How does it account for the existence of threshold frequency for a given material ? [2]
- D) Show that the focal length is half the radius of curvature for a concave mirror of small aperture. [2]
- E) Derive the expression for the path difference between the two interfering waves in Young's double slit experiment. Hence obtain the expression for the fringe width. [2]
- F) The curve shown in the figure below represents the hysteresis curve for a ferromagnetic material. Explain the parts of the curve  $Oa$ ,  $ab$ ,  $bc$ ,  $cd$ ,  $de$ , on the basis of the domain theory. [3]



3. A) When the hydrogen atom is in its first excited level, its radius is [1]
- Half its ground state radius
  - Twice its ground state radius
  - Three times its ground state radius
  - Four times its ground state radius

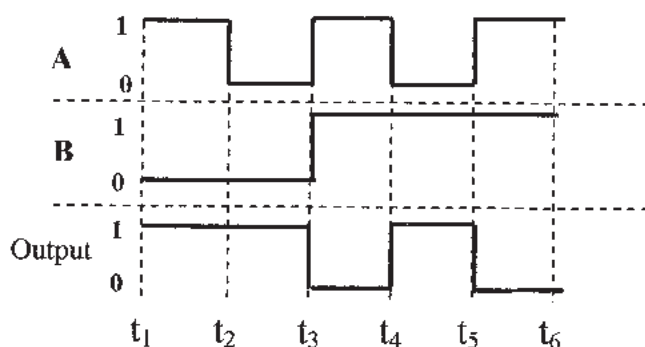


B) State two factors on which the specific electrical resistance of a conductor depends upon. [1]

C) A difference of 3.3 eV separates two energy levels in a hydrogen like atom. Calculate the frequency of radiation emitted when the atom makes a transition from the upper level to the lower level ? [2]

D) Explain by giving two reasons, why we choose not to transmit an audio signal by just directly converting it to an e.m. wave of the same frequency. [2]

E) The input and output waveforms of a Gate are given in the figure below. Identify the Gate and write its truth table. [2]



F) Explain, with the help of a ray diagram, how the phenomenon of total internal reflection is used in [3]

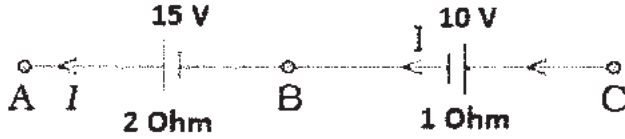
- 1) An optical fibre.
- 2) A prism that inverts the image without changing its size.

4. A) A power transmission line feeds input power at 4.6 kV to an ideal step down transformer, with its primary winding having 6000 turns. In order to get 230 V output voltage the number of turns needed in the secondary are [1]

- 200 turns
- 300 turns
- 400 turns
- 500 turns



- B) Two cells of e.m.f's 15 V and 10 V having internal resistance  $2 \Omega$  and  $1 \Omega$  are connected as shown in the figure below. What is their equivalent e.m.f. ? [1]



- C) A radioactive sample A having an activity of  $5 \mu\text{Ci}$  has twice the number of nuclei as another sample B which has an activity of  $10 \mu\text{Ci}$ . Calculate the half lives of A and B. [2]

D)

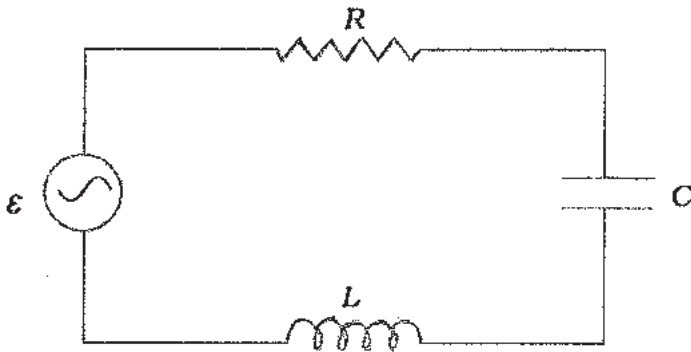
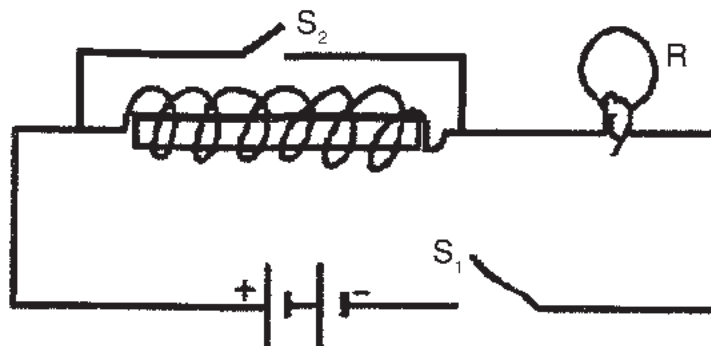


Figure shows a ideal series LCR circuit connected to a.c. mains of voltage  $\epsilon$ ,

- When is the current maximum in the resistor ?
- Give the formula for the frequency of the circuit when the current in the resistor is maximum.
- What is the phase angle between the voltage in the capacitor and the inductor ?

[3]

OR





The figure shows :

In situation 1, a light bulb 'B' and an ideal iron cored inductor are connected to a DC battery having a voltage sufficient to light up the bulb through a switch ( $S_1$ ). When switch ( $S_1$ ) is closed the bulb lights up brightly.

a) What will one observe when switch ( $S_2$ ) is closed ?

In situation 2, the DC battery is replaced by an ac source of r.m.s. voltage equal to the voltage of the DC battery. The switch ( $S_1$ ) is closed and ( $S_2$ ) is kept open.

b) How will the glow of the bulb change when compared to situation 1 ?

c) If the iron core is now slowly withdrawn, how will the glow of the bulb change ?

E) Derive an expression for the electric field intensity at a point on the equatorial line of an electric dipole.

[4]

Why is the net force on an electric dipole placed in the uniform electric field zero ?

OR

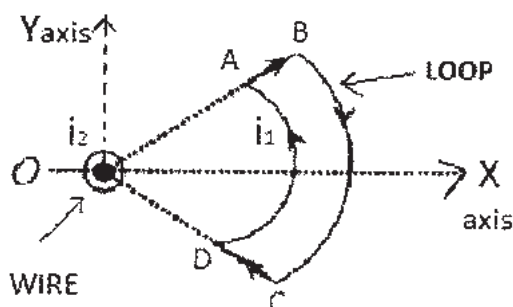
E) Using Gauss theorem, derive an expression for the electric field intensity due to a uniformly charged spherical shell at a point outside its surface.

Why is the electric field inside a charged spherical shell zero ?

5. A) A loop ABCD kept in the plane of the paper (i.e. the plane of X-axis with  $\pm Y$ -axis) carries a current  $i_1$ . A long straight wire carrying current  $i_2$  along the +Z axis is placed at its centre. An observer 'O' situated on the - X axis, looks at the loop along OX as shown in the figure.

[1]

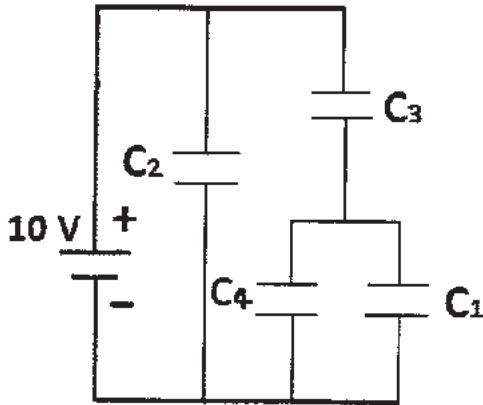
Then the observer finds that the loop



- Moves away from him due to the non-zero net force acting on the loop.
- Moves towards him due to the non-zero net force acting on the loop.



- The arc will rotate clockwise as only a torque acts on the loop the arc will rotate anticlockwise as only a torque acts on the loop.
- B) Plane microwaves are incident normally on a single slit of width 4 cm and the first minimum is formed at  $30^\circ$ . What is the wavelength of the wave? [1]
- C) A horizontal straight wire of length ' $l$ ' extending from east to west is falling with speed ' $v$ ', at right angles to the horizontal component of the earth's magnetic field ' $B_H$ ' [2]
- a) What is the direction of the induced e.m.f ?
- b) Which end of the wire is at higher electrical potential ?
- D) Four capacitors  $C_1 = 1\mu\text{F}$ ,  $C_2 = 3\mu\text{F}$ ,  $C_3 = 4\mu\text{F}$  and  $C_4 = 5\mu\text{F}$  are connected to a dc supply having 10 V potential difference as shown in the circuit diagram. Calculate the charge on capacitor  $C_3$ . [3]



- E) With the help of a circuit diagram explain the working of a transistor as an amplifier in the C-E configuration. [4]
- In which of these states viz. cut off, active and saturation, does a transistor have to work when it is used as a switch ?

OR

- E) With the help of a circuit diagram explain the role of the two important processes involved in the formation of a p.n. junction.
- What is zener breakdown of a diode ?