2018 VI 08 1430 Seat No. : | | | | | |

Time : $2^1/_2$ Hours **PHYSICS (Old Pattern)**

Subject Code

H	7	0	2

Total No. of Questions : 5 **(Printed Pages : 7)** **Maximum Marks : 55**

INSTRUCTIONS : *i)* ***All*** *questions are* ***compulsory.***

ii) Answers to the multiple choice questions should be written by choosing and writing the correct alternative.

iii) There is no overall choice. However internal choice has been provided in ***two*** *questions of four marks* ***each*** *and* ***one*** *question of* ***three*** *marks.*

iv) ***Use*** *of calculators is* ***not*** *permitted.* ***However****, you may ask for mathematical tables.*

v) You may use the following values of ***physical*** *constants* ***wherever*** *necessary :*

Constants :

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

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

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

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

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

$$\frac{1}{4\pi\varepsilon_0} = 9 \times 10^9 \text{ Nm}^2\text{C}^{-2}$$

$\pi = 3.14$

$\varepsilon_0 = 8.85 \times 10^{-12}$C^2/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]**

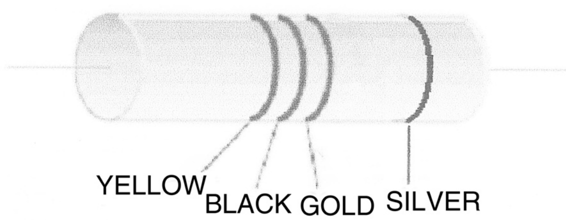
i) Remote switches in household electronic systems.

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]**

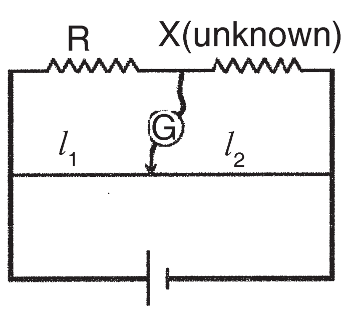
E) Two circular coils X and Y, having the same number of turns but with radii 10 cm and 5 cm respectively are placed in the horizontal plane with their centre's coinciding with each other. Coil X has a current 3 A flowing through it in the clockwise sense. Calculate the current that has to flow in coil 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

- Descreasing 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.

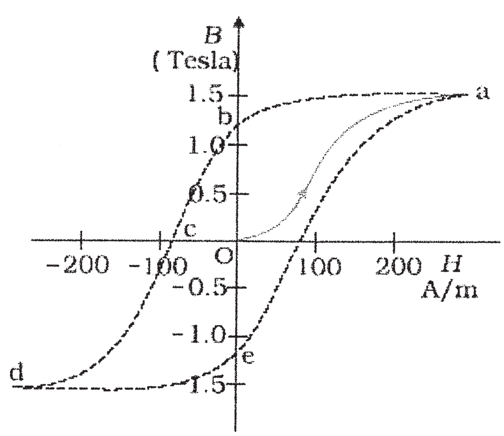
B) Why are sharp points used as electrodes in the Van de Graaff generator ? **[1]**

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]**



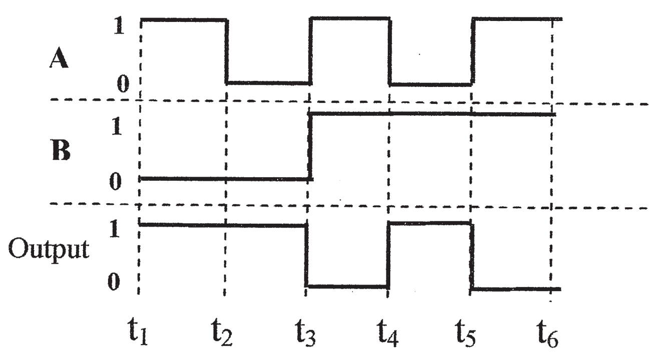
3. A) When the hydrogen atom is in its first excited level, its radius is **[1]**
   - Half its ground state radius
   - Twice its ground state radius
   - Three times its ground state radius
   - Four times its ground state radius

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]**

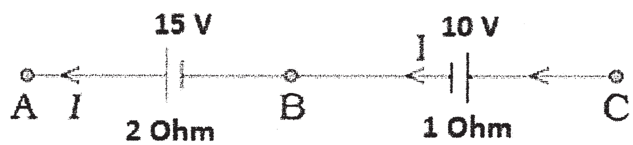
1) An optical fibre.

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 Ω and 1Ω 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 μCi has twice the number of nuclei as another sample B which has an activity of 10 μCi. Calculate the half lives of A and B. **[2]**

D)

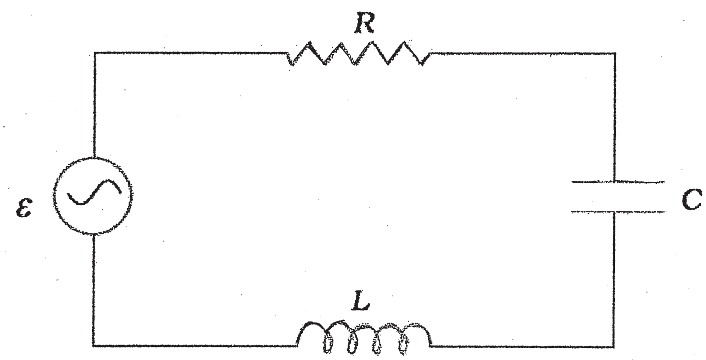


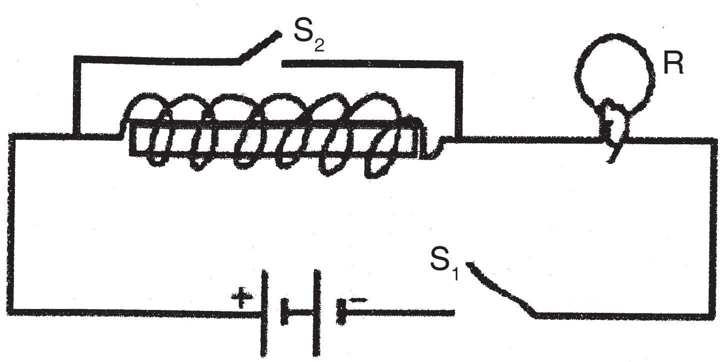
Figure shows a ideal series LCR circuit connected to a.c. mains of voltage ε,

a) When is the current maximum in the resistor ?

b) Give the formula for the frequency of the circuit when the current in the resistor is maximum.

c) 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]**

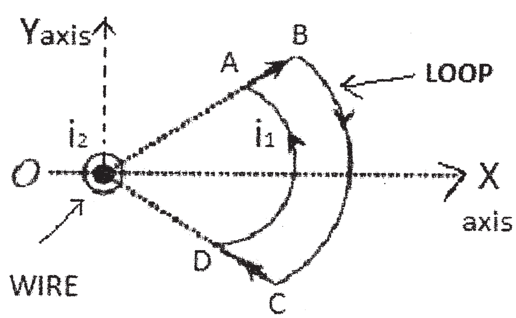
Why is the net force on an electric dipole placed in the uniform electric field zero ?

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 ±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.

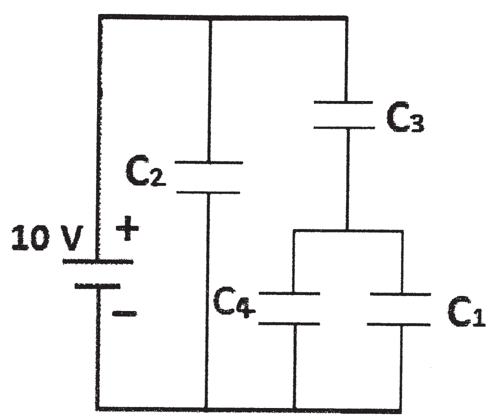
B) Plane microwaves are incident normally on a single slit of width 4 cm and the first minimum is formed at 30°. What is the wavelength of the wave ? **[1]**

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 $C_1 = 1\mu F$, $C_2 = 3\mu F$, $C_3 = 4\mu F$ and $C_4 = 5\mu F$ 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 ?