Series SSO/2

Code No. 043/12/02

Candidates must write the code on the title page of the answer book

Roll No.

- Please check that this question paper contains **7** printed pages.
- Code number given on the right hand side of the question paper should be written on the title page of the answer book by the candidate.
- Please check that this question paper contains **27** questions.
- **Please write down the serial number of the question before attempting it.**
- **15** minutes' time has been allotted to read this question paper. The student will read the question paper only and will not write any answer on the answer script during this period.

First Pre Board Examination, 2018-2019

PHYSICS

Grade: 12 **Time: 3 hours**

Date: 31.01.2019 **Max. Marks: 70**

General Instructions:

(i) All questions are compulsory

(ii) Marks for each question are indicated against it.

(iii) The question paper consists of four sections A, B, C and D.

(iv) Internal choice is given in all the sections. ***A student has to attempt only one of the alternatives in such questions.***

(v) Section-A contains 5 questions of 1 mark each.

(vi) Section-B has 7 questions of 2 marks each.

(vii) Section-C is of 12 questions of 3 marks each

(viii) Section-D has 3 questions of 5 marks each.

(ix) Question number 1 to 5 are very short-answer questions and carry 1 mark each.

(x) Wherever necessary, the diagrams drawn should be beat and properly labelled.

(xi) Use Log Tables, if necessary. Use of calculators is not allowed

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

$h = 6{\cdot}63 \times 10^{-34}$ Js

$e = 1{\cdot}6 \times 10^{-19}$ C

$\mu_o = 4\pi \times 10^{-7}$ T m A^{-1}

$\varepsilon_o = 8{\cdot}854 \times 10^{-12}\ C^2\ N^{-1}\ m^{-2}$

$\frac{1}{4\pi\varepsilon_o} = 9 \times 10^{9}\ N\ m^2\ C^{-2}$

$m_e = 9{\cdot}1 \times 10^{-31}$ kg

Mass of neutron = $1{\cdot}675 \times 10^{-27}$ kg

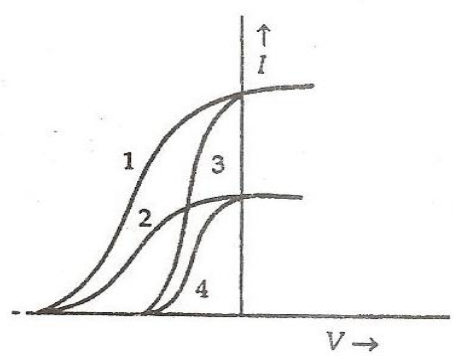
Mass of proton = $1{\cdot}673 \times 10^{-27}$ kg

Boltzmann constant = $1{\cdot}38 \times 10^{-23}\ JK^{-1}$

1. Define the term 'Mobility' of charge carriers in a conductor. Write its S.I. unit. (1)

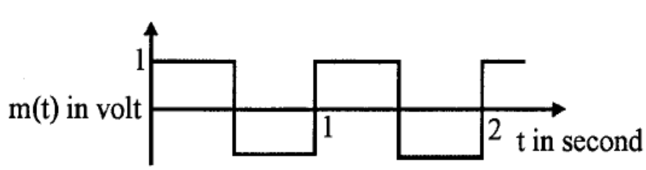
   OR

   An electric dipole of dipole moment 20×10^{-6} C is enclosed by closed surface. What is the net electric flux coming out of this surface?
2. What are the directions of electric and magnetic field vectors relative to each other and relative to the direction of propagation of electromagnetic waves? (1)
3. The given graph shows the variation of photo-electric current (I) versus applied voltage (V) for two different photosensitive materials and for two different intensities of the incident radiation. Identify the pairs of curves that correspond to different materials but same intensity of incident radiation. (1)



   OR

   In photoelectric effect, why should the photoelectric current increase as the intensity of monochromatic radiation incident on the photosensitive surface is increased? Explain.
4. The carrier wave is given by $C_{(t)} = 12 \sin(8\pi t)$ volt. The modulating signal is a square wave as shown. Find modulation index. (1)

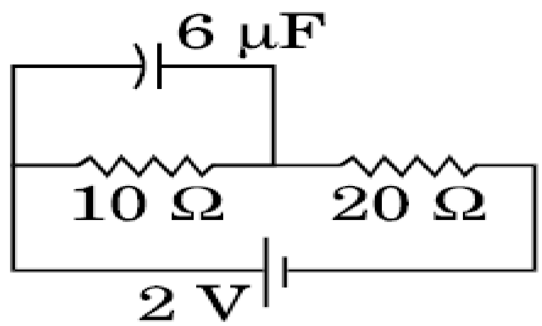


5. Why is it found experimentally difficult to detect neutrinos in nuclear β-decay? (1)
6. Define the term modulation. Draw a block diagram of a simple modulator for obtaining AM signal. (2)
7. An electric dipole of length 4 cm, when placed with its axis making an angle of 60^o with a uniform electric field, experiences a torque of $4\sqrt{3}$Nm. Calculate the potential energy of the dipole, if it has charge +8 nC. (2)

OR

An electric dipole with a dipole moment 4×10^{-9} Cm is aligned at 30^0 with the direction of a uniform electric field of magnitude 5×10^4 NC^{-1}. Calculate the magnitude of the torque acting on the dipole.

8. Find the charge on the capacitor as shown in the circuit. (2)



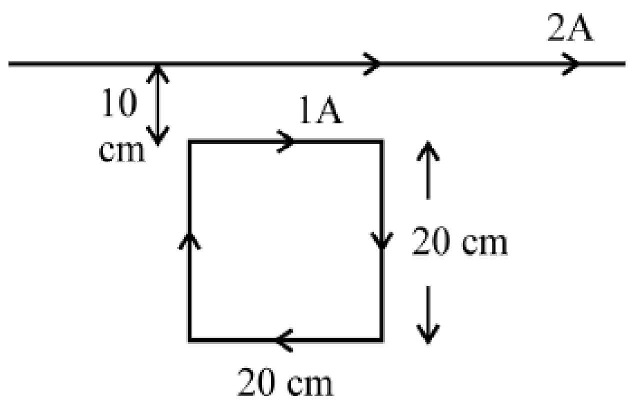
OR

An ammeter of resistance 0.80Ω can measure current upto 1.0A.

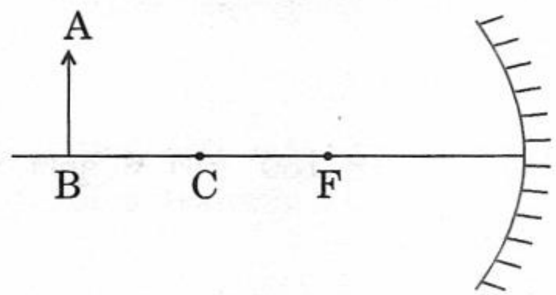
(i) What must be the value of shunt resistance to enable the ammeter to measure current up to 1.0A?

(ii) What is the combined resistance of the ammeter and the shunt?

9. (a) Define magnetic flux. Write its S.I unit. (2)
(b) What is the phase difference between the current and voltage in a L.C.R circuit at resonance.
10. A square loop of side 20 cm carrying current of 1A is kept near an infinite long straight wire carrying a current of 2A in the same plane as shown in the figure. Calculate the magnitude and direction of the net force exerted on the loop due to the current carrying conductor. (2)



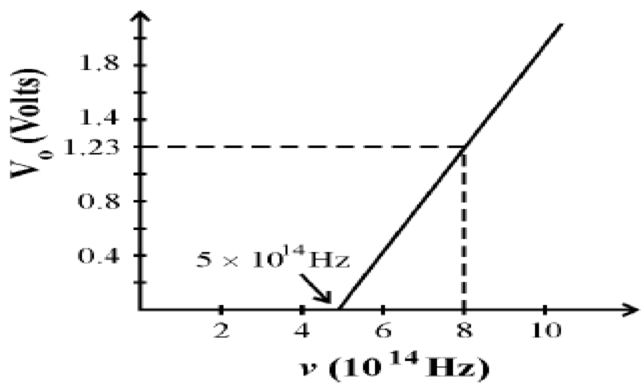
11. ~~An object AB is kept in front of a concave mirror as shown in the figure. (2)~~



(i) Complete the ray diagram showing the image formation of the object.

(ii) How will the position and intensity of the image be affected if the lower half of the mirror's reflecting surface is painted black?

12. Using the graph shown in the figure for stopping potential V/s the incident frequency of photons, calculate Planck's constant. (2)

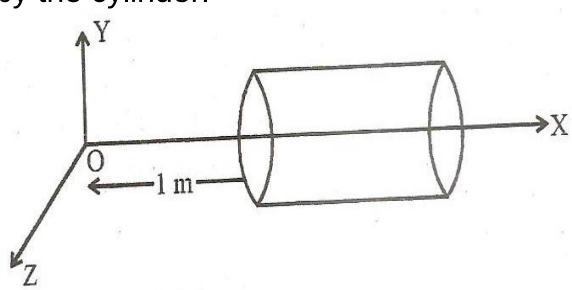


13. Describe briefly, by drawing suitable diagrams, the (i) sky wave and (ii) space wave modes of propagation. Mention the frequency range of the waves in these modes of propagation. (3)

14. A hollow cylindrical box of length 1m and area of cross section $25cm^2$ is placed in a three dimensional coordinate system as shown in the figure. The electric field in the region is given by E= 50xi, where E is in NC^{-1} and x is in meters. Find (3)

(a) Net flux through the cylinder.

(b) Charge enclosed by the cylinder.



15. Briefly explain Davisson and Germer experiment to demonstrate the wave nature of electrons . (3)

16. A capacitor made of two parallel plates each of plate area A and separation d, (3) is being charged by an external ac source. Show that the displacement current inside the capacitor is the same as the current charging the capacitor.

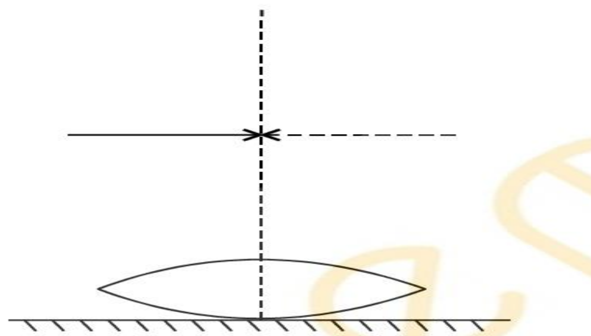
OR

Write the expression for the generalized form of Ampere's circuital law. Discuss its significance and describe briefly how the concept of displacement current is explained through charging / discharging of a capacitor in an electric circuit.

17. Which two of the following lenses L1, L2 and L3 will you select as objective and (3) eyepiece for constructing best possible (i) telescope (ii) microscope? Give reason to support your answer.

Lens(L)	Power (P)	Aperture(A)
L1	3D	8cm
L2	6D	2cm
L3	10D	1cm

18. A symmetric biconvex lens of radius of curvature R and made of glass of (3) refractive index 1·5, is placed on a layer of liquid placed on top of a plane mirror as shown in the figure. An optical needle with its tip on the principal axis of the lens is moved along the axis until its real, inverted image coincides with the needle itself. The distance of the needle from the lens is measured to be x. On removing the liquid layer and repeating the experiment, the distance is found to be y. Obtain the expression for the refractive index of the liquid in terms of x and y.



19. Define self-inductance of a coil. Show that magnetic energy required to build up the current I in a coil of self inductance L is given by ½ LI^2. (3)

20. What is meant by modulation? Explain the need of modulation. (3)

OR

What are energy bands? How are these formed? Distinguish between a conductor, an insulator and a semiconductor on the basis of energy band diagram.

21. (i) Why do we prefer a potentiometer to measure the emf of a cell rather than (3) a voltmeter?

(ii)What is the advantage of using thick metallic strips to join wires in a potentiometer?

OR

Draw a circuit diagram showing balancing of Wheatstone bridge. Use Kirchhoff's rules to obtain the balance condition in terms of the resistances of four arms of Wheatstone Bridge.

22. Draw a circuit diagram of a transistor amplifier in CE configuration. (3)
Define the terms: (i) input resistance and (ii) Current amplification factor. How are these determined using typical input and output characteristics?

23. Find the nuclear reactions for (3)
   (i) α-decay $^{226}Ra_{88}$
   (ii) β+ decay of $^{11}C_6$
   (iii) Electron capture of $^{120}Xe_{54}$

OR

Write Einstein’s photoelectric equation and point out any two characteristic properties of photons on which this equation is based.

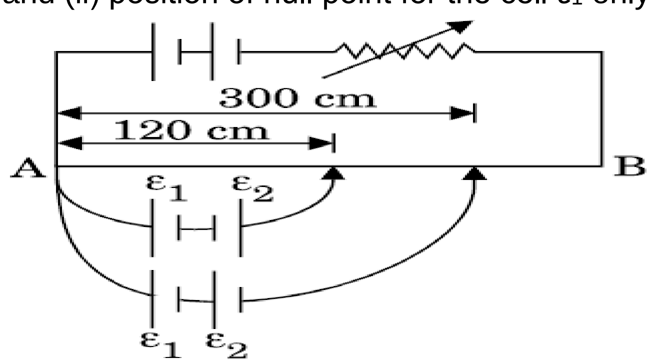
24. Define the following using suitable diagrams: (i) magnetic declination and (ii) angle of dip. In what direction will a compass needle point when kept at the (a) poles and (b) equator? (3)

25. (a) (i)Two independent monochromatic sources of light cannot produce a sustained interference pattern'. Give reason.
(ii) Light waves each of amplitude “a” and frequency “ω", emanating from two coherent light sources superpose at a point. If the displacements due to these waves is given by y_1 = a cos ωt and y_2=a cos(ωt + Φ) where Φ is the phase difference between the two, obtain the expression for the resultant intensity at the point.
(b) In Young's double slit experiment, using monochromatic light of wavelength λ_2 intensity of light at a point on the screen where path difference is λ, is K units. Find out the intensity of light at a point where path difference is λ/3.

OR

(a) How does one demonstrate, using a suitable diagram, that unpolarised light when passed through a Polaroid gets polarised ?
(b) A beam of unpolarised light is incident on a glass-air interface. Show, using a suitable ray diagram, that light reflected from the interface is totally polarized, when μ =tan i_B, where μ is the refractive index of glass with respect to air and i_B, is the Brewster's angle.

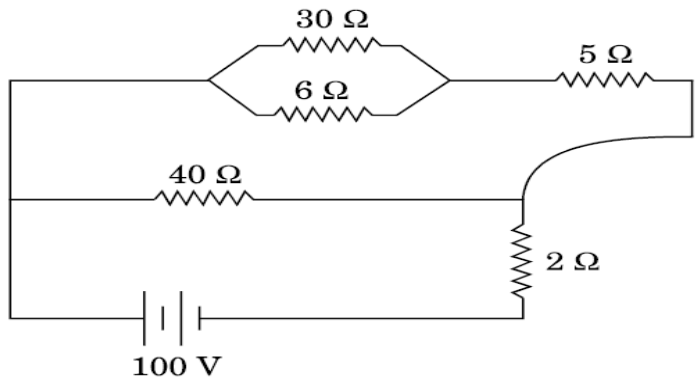
26. (a)State the principle of a potentiometer. Define potential gradient. Obtain an expression for potential gradient in terms of resistivity of the potentiometer wire.
(b)Figure shows a long potentiometer wire AB having a constant potential gradient. The null points for the two primary cells of emf’s ε_1 and ε_2 connected in the manner shown are obtained at a distance of l_1 = 120 cm and l_2 = 300 cm from the end A. Determine (i) $\varepsilon_1/\varepsilon_2$ and (ii) position of null point for the cell ε_1 only.



OR

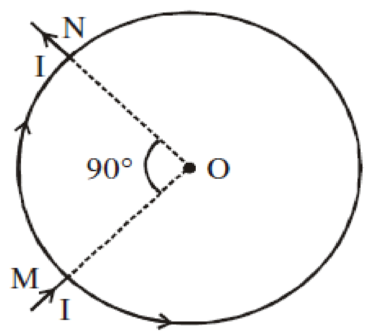
(a) Define the term ‘drift velocity’ of charge carriers in a conductor. Obtain the expression for the current density in terms of relaxation time.

(b) A 100 V battery is connected to the electric network as shown. If the power consumed in the 2 Ω resistor is 200 W, determine the power dissipated in the 5 Ω resistor.



27. (a) Use Biot-Savart law to derive the expression for the magnetic field due to a circular coil of radius R having N turns at a point on the axis at a distance 'x' from its centre. Draw the magnetic field lines due to this coil.

(b)A current 'I' enters a uniform circular loop of radius 'R' at point M and flows out at N as shown in the figure. Obtain the net magnetic field at the centre of the loop.



OR

(a)Show how Biot-Savart law can be alternatively expressed in the form of Ampere's circuital law. Use this law to obtain the expression for the magnetic field inside a solenoid of length 'l', cross-sectional area 'A' having 'N' closely wound turns and carrying a steady current 'I'. Draw the magnetic field lines of a finite solenoid carrying current I.

(b) A straight horizontal conducting rod of length 0.45 m and mass 60 g is suspended by two vertical wires at its ends. A current of 5.0 A is set up in the rod through the wires. Find the magnitude and direction of the magnetic field which should be set up in order that the tension in the wire is zero.