1. All questions are compulsory.
2. Q. 1 to 5 are Very short Answer type questions (1 Mark each.)
3. Q. 6 to 12 are short Answer type questions. (2 Marks each.)
4. Q. 13 to 24 are short answer questions (3 Marks each.)
5. Q. 25 to 27 are Long Answer type questions, (5 marks each.)
6. Please write down the serial number of the question before attempting it.
7. You may use the following values of physical constants where ever necessary:

Permittivity in free space (ε_0)	= 8.85×10^{-12} F/meter
Permeability in free space (μ_0)	= $4\pi \times 10^{-7}$ T m A^{-1}
Mass of Proton (m_p)	= 1.67×10^{-27} kg
Mass of electron (m_e)	= 9.1×10^{-31} kg.
Charge on electron or proton (e)	= 1.6×10^{-19} C
Velocity of Light (C)	= 3×10^{8} m/sec
Avogadro's Number (N)	= 6.023×10^{23}
Plank's Constant (h)	= 6.626×10^{-34} J. Sec

8. Use of calculators is not permitted. However, you may ask log table for Mathematical tables.

1.An electron beam passes through a region of crossed electric and magnetic fields of strengths E and B respectively. For what value of electron speed the beam will remain undeflected?
2.As soon as the current is switched on ahigh voltage wire, the bird sitting on it flies away, why?
3.A semiconductor has equal electron and hole concentration $6x10^3$ m^{-3}.On doping with a certain impurity the electron hole ratio becomes 4:3.Identify the type of semiconductor after doping.
4.Identify the part of the electromagnetic spectrum to which waves of frequency (i)10^9 Hz (ii)10^{20}Hz belong. Calculate the ratio of their velocities in glass.(μ =1.5).
5.How does the fringe width affected if entire interference experiment is dipped in the water?
6.Write the expression for energy of photons in permitted energy level of electron. Calculate energy of photons when an electron comes back from second energy level to first energy level.
7.What is the power dissipated in an a.c. circuit in which voltage and current are given by V=230 Sin(wt + Π/2) and I =10 Sin wt ?
8.How is band gap, Eg, of a photo diode related to the maximum wavelength λm, that can be detected by it?
9.Avoltmeter is connected between the plates of a charged capacitor. If the plates of the capacitor are moved farther apart , what will be the effect on the reading of voltmeter?
10.Write the mathematical relation for the resistivity of a material in terms of relaxation time, number density, and mass and charge carriers in it. Explain, using this relation , why the resistivity of a metal increases and that of a semiconductor decreaseswit rise in temperature?
11.Define resolving power of a telescope. How would it change with increase of (i)aperture of the objective and (ii) wavelength of light?
12.The susceptibility of a magnetic material is -0.085.Identify the magnetic material.A specimen of this material is placed in a uniform magnetic field. Draw the modified field pattern.
13. Find the wavelength of E.M. waves of frequency5 $x10^{19}$ Hz in free space .Give its two applications.
14.The following data was recorded for values of object distance and the corresponding values image distance in the experiment on study of real image formation by a concave mirror of radius of curvature 40 cm.One of these observations is incorrect .Identify this observation and give reason for your choice.

S.NO	1	2	3	4
Object Distance (in cm)	25	30	36	40
ImageDistance (in cm)	100	60	42	40

15.Two primary cells of emf,s E_1 and E_2 ($E_1 > E_2$) are connected to a potentiometer wireAB as shown in fig.If the balancing lengths for the two combinations of the cells are 250 cm and 400 cm, find the ratio of E_1 and E_2 .
16.If a photosensitive surface has a threshold frequency 4.6 x10 Hz .Calculate the minimum energy of photon (eV)which will emit photo-electron.

OR

For photoelectric effect in sodium ,the figure shows the plot of cut-off voltage versus frequency of incident radiation.Calculate (i) threshold frequency ,(ii) work finction for sodium.

17Use basic laws of radioactive decay to show that radioactive nuclei follow on radioactive decay law.

18.State two factors by which the range of T.V.signals can be increased?

19.(a) In a meter bridge the balance point is found to be at 39.5 cm from the end A ,when the resistance Y is of 12.5Ω.Determine the resistance X

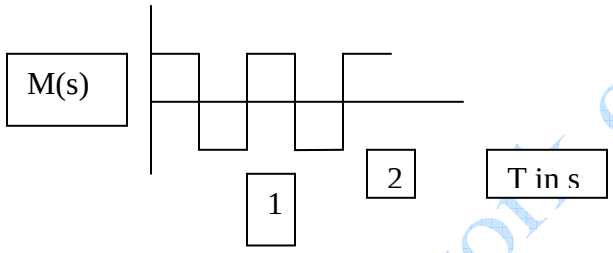
(b) Determine balance point of the bridge if X and Y are interchanged.

© What happens if the galvanometer and cell are interchanged ?

OR

Find the current drawn from a cell of emf 1V and internal resistance 2/3Ω connected to the network given.

20.A modulating signal is a square wave as shown



The carrier wave is given by c (t) =2 sin (8πt)

(i) Sketch the amplitude modulated waveform

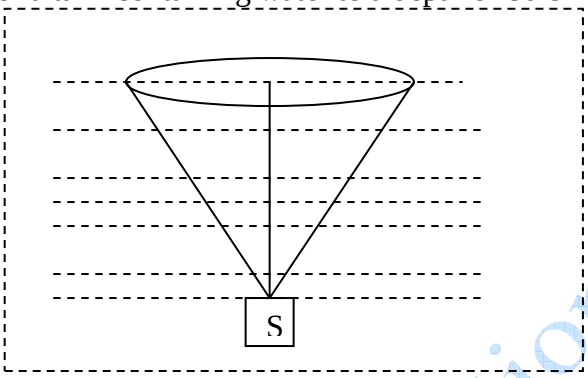
(ii) What is the modulation index?

21 Two charged conducting speherss of radii a and b are connected to each other by a conducting wire .What is the ratio of (i) charges on the spheres and (ii) electric fields at the surfaces of the two spheres.

22.At what angle should a ray of light be incident on the face of a refracting angle 60ºso that it just suffers total internal reflection at the other face?The refractive index of prism is 1.5?

23.A circuitvcontaining a 80mH inductor ,a 60μF capacitor and a 15 Ω resistor are connected to a 230 V ,50 Hz supply.Obtain the averagev power transferred to each element of the circuit and total power absorbed.

24.A small bulb is placed at the bottom of a tank containing water to a depth of 80 cm



.What is the area of the surface of water through which light from the bulb can emerge out? Refractive index of water is 4/3.

25.Ahorizontal straight wire 10m long extending from east to west is falling with a speed of 5.0 ms^{-1} at right angles to the horizontal component of the earth,s magnetic field equal to 0.30 x 10^{-4}Wb $m^{-2.}$

(a) What is the instantaneous value of emf induced in the wire ?

(b) What is thedirection of emf?

(c) Which emf of the wire is at the higher electrical potential?

25. a) Explain the construction and working of a Van de Graaph generator.

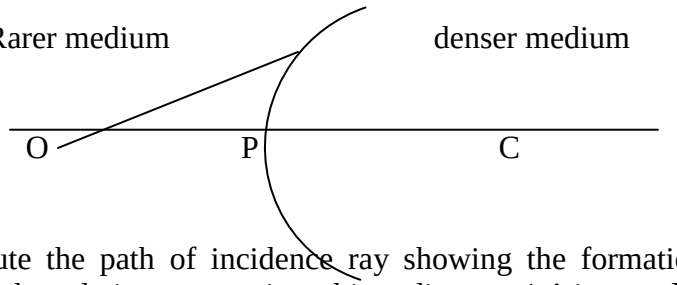
b) A metal wire is bent into a circle of radius 10 cm . It is given a charge of 200μ C which spreads on it uniformly. Calculate the electric potential at its centre.

OR

a) State the theorem which relates the enclosed charge, inside a closed surface, with the electric flux through it. Use this theorem to obtain the electric field at a point due to a uniformly charged thin plate.

b) An electric charge of 8.85 X 10^{-13} C is placed at the center of a sphere of radius 1m. what is the total electric flux linked with the sphere?

26 . a) A spherical surface of radius of curvature R, separates a rarer and denser medium as shown in figure



Compute the path of incidence ray showing the formation of image. Hence derive the relation connecting object distance ‘u’ image distance ‘v’ radius of curvature R and refractive indices n_1 and n_2.

b) Draw the ray diagram of astronomical telescope .

27. (a) With the help of a circuit diagram explain the working of transistor as oscillator.

(b) Draw a circuit diagram for a two input OR gate and explain its working With the help of input, output waveforms.

OR

(a) Explain briefly with the help of a circuit diagram how V-I characteristics of a p-n junction diode are obtained in
(i) forward bias, and (ii) reverse bias.

(b) A photodiode is fabricated from a semiconductor with a band gap of 2.8 eV. Can it detect wavelength of 6000 nm ? Justify.