General instructions to Candidates

- Each question from 1 – 8 carry 1 mark each
- Each question from 9 – 18 carry 2 marks each
- Each question from 19 – 27 carry 3 marks each
- Each question from 28 – 30 carry 5 marks each
- Fill the OMR sheet correctly because wrong filling might lead to reduction of marks.
- Write the code of the paper properly in the space provided in the OMR sheet

1) Write the quantities represented by the following units:-
   (a) Nm^2/C (b) Wb/m^2

2) Draw a graph for E vs. r and V vs. r for a hollow sphere of charge.

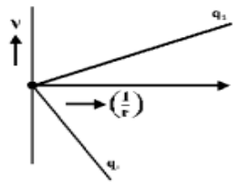
3) Write the four properties of electric charge

4) Draw electric Field lines for a point charge 'q' (i) q<0 and (ii) q>0

5) Estimate the average drift speed of conduction electrons in a copper wire of cross-sectional area $1.0 \times 10^{-7}\ m^2$ carrying a current of 1.5 A. Assume that each copper atom contributes roughly. Atomic Density of copper is 9000 kg/cu.m and mass is 63.5u

6) Define Mobility of conduction electrons and give its SI units.

7) The given graph is for 2 charges q1 and q2
   Find the sign of the 2 charges and which one has a larger magnitude?



8) Define electric Flux and write its SI unit.
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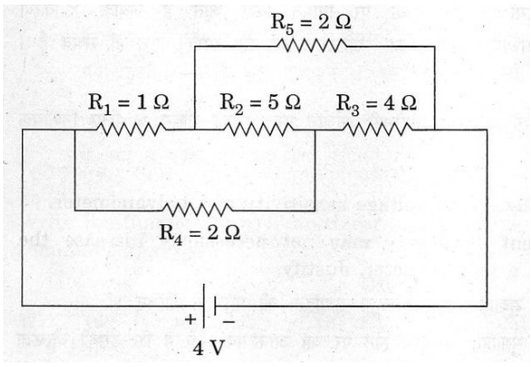
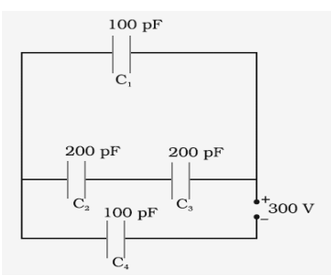
9) Calculate the current drawn from the battery



10) Define equipotential surfaces and draw 3 equipotentials for an electric field that increases uniformly say in Z direction. What is the difference in these equipotentials from those formed due to an uniform electric field.

11) Define Current and voltage sensitivity of a moving coil galvanometer and explain the statement " The change in current sensitivity needn't change the voltage sensitivity"

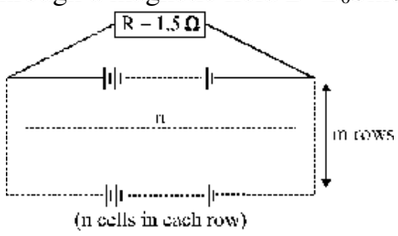
12) A positive charge (+q) is kept near an uncharged plate. Sketch the field lines that originate from the positive charge on to the uncharged metal plate. Find the capacitance of the given system: -



13) a) Define a direction for the force experienced by a charged particle projected into a magnetic field 'B' with a velocity 'v' and the angle between B and v is 60^o.

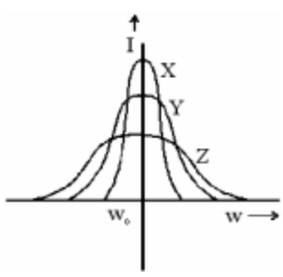
b) Write the expression for current drawn from a ring made of metal which has resistance R and is rotated through a magnetic field $B=B_0 Sin\alpha$.

14)



12 cells, each of emf 1.5V and internal resistance 0.5 ohm, are arranged in m rows each containing n cells connected in series, as shown. Calculate the values of n and m for which this combination would send maximum current through an external resistance 1.5 ohm.

15) Three students X, Y, and Z performed an experiment for studying the variation of alternating currents with angular frequency in a series LCR circuit and obtained the graphs shown below. They all used a.c. sources of the same r.m.s. value and inductances of the same value.
What can we (qualitatively) conclude about the
(i) Capacitance value
(ii) Resistance values
used by them? In which case will the quality factor be maximum?
What can we conclude about nature of the impedance of the set up at frequency w_o?



16) Write the frequency range and wavelength of X-rays and microwave

17) What are eddy currents? Explain any 2 of their applications

18) Give 2 transformer losses and explain methods to solve them

19) State gauss' Law and prove that the electric field inside a hollow sphere is always 0 and also show that the electric field due to a spherical shell is as if the whole charge is concentrated at the center of the sphere.

20) Explain the principle, construction and working of an AC generator with relevant labeled diagrams of the same.

21) State Biot-savart's law and derive an expression for magnetic field at a point on the axis of a circular ring carrying current 'I' using the same.

22) What is a capacitor? Derive an expression for the energy stored in a capacitor and explain where this energy is stored.

23) A magnetic needle has magnetic moment 6.7×10 Am^2 and moment of inertia 7.5×10^{-6} kg m^2. It performs 10 complete oscillations in 6.70 s. What is the magnitude of the magnetic field?

24) Explain the 3 components of earth's magnetic field

25) State the Wheatstone bridge network principle and derive its balance condition

26) What is resonance condition? Derive an expression for time interval 'T' in a LC oscillator

27) What are ohmic and non-ohmic conductors? Explain with examples and relevant graphs

28) a) State Kirchoff's laws of electricity (2)
b) Using potentiometer principle. Explain how a potentiometer is used to compare EMF of 2 cells.(3)

29) a) What are the different types of magnetic materials available? Explain (3)
b) Derive an expression for magnetic moment of a revolving electron (2)

30) For a LCR series network, derive expressions for impedance, power factor, phase angle, instantaneous current using analytical method when a varying voltage of V=V'sinwt passes through the circuit. (5)