AMRITA VIDYALAYAM
FIRST TERM (2014-15)
SET -1

CLASS : - XII **SUBJECT:- PHYSICS**
TIME ALLOWED:- 1hr **MAX.MARK:- 70**

General Instructions

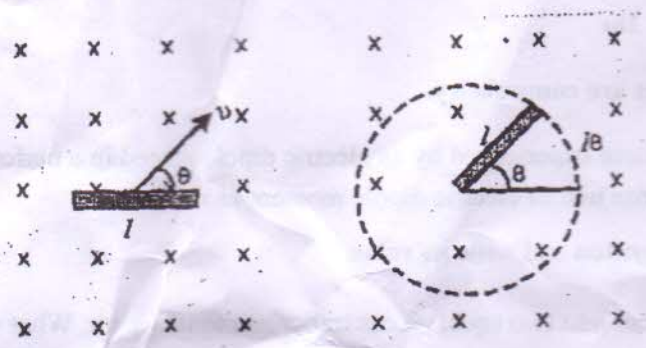
1. All questions are compulsory.

1.	What is the net force experienced by an electric dipole placed in a uniform electric field?	1
2.	Is it correct to write unit of electric dipole moment as mC?	1
3.	Define Bohr magneton and write its value.	1
4.	A bar magnet is cut into two equal pieces transverse to its length. What will happen to its magnetic moment?	1
5.	Prove that inductor offers an easy path to d.c but resistive path for a.c.	1
6.	The charge flowing in a conductor varies with time as $q = 2t - 6t^2 + 10t^3$, where q is in coulomb and t in second. Find (i) initial current (ii) the time after which the value of current reaches a maximum value.	2
7.	Two point charges of 2 μC and 8 μC are placed 12 cm apart. Find the position of the point where the electric field intensity will be zero.	2
8.	What is the force on a wire of length 4.0 cm placed inside a solenoid near its centre, making an angle of 60^0 with its axis? The wire carries a current of 12 A and the magnetic field due to the solenoid has magnitude of 0.25T.	2
9.	A steel wire of length l has a magnetic moment M. It is bent into a semicircular arc. What is the new magnetic moment?	2
10.	Show that the energy stored in an inductor L, when a current I is established through it, is $(½)LI^2$.	2
11.	Two point charges of magnitude 2×10^{-7} C and 8.5×10^{-8} C are 0.1m apart. Calculate electric field intensity that each charge produces at the site of the other.	3
12.	State Gauss' theorem in electrostatics. Use it to obtain an expression for the electric field intensity at a point near an infinitely long plane sheet of charge.	3
13.	Derive an expression for the capacitance of a parallel plate capacitor with a dielectric slab of thickness less than the spacing between the plates inserted between the plates. Discuss the special cases.	3
14.	A 10μF capacitor is charged by a 30V dc supply and then connected across a an uncharged identical 50μF capacitor. Calculate (i) the final potential difference across the combination, and (ii) the initial and final energies. How will you account for the difference in energy?	3
15.	Discuss the principle of potentiometer and explain the determination of internal resistance of a cell by using a potentiometer.	3
16.	An electron is moving at 10^6 m/s in a direction parallel to a current of 5 A, flowing through an infinitely long straight wire, separated by a perpendicular a distance of 10 cm in air. Calculate the magnitude of the force experienced by the electron.	3
17.	How will a dia, para and a ferromagnetic material behave when kept in a non-uniform external magnetic field? Give two examples of each of these materials. Name two main characteristics of a ferromagnetic material which help us to decide its suitability for making (i) a permanent magnet (ii) an electromagnet.	3
18.	A bar magnet of magnetic moment 1.5 J/T lies aligned with the direction of a uniform magnetic field of 0.22 T. (a) What is the amount of work required by an external torque to turn the magnet so as to align its magnetic moment?	3

(i) Normal to the field direction, and (ii) opposite to the field direction?

(b) What is the torque on the magnet in cases (i) and (ii)?

Calculate the rate at which the flux linked with the generated area changes with time when a rod of length l is (a) translated (b) rotated in a uniform field of induction b as shown in fig. 3



20. A series LCR circuit with L = 0.12 H, C = 480 nF, R = 23 ohm is connected to a 230 V variable frequency supply. 3

(a) What is the source frequency for which current amplitude is maximum? Obtain this maximum value.

(b) What is the source frequency for which average power absorbed by the circuit is maximum? Obtain the value of this maximum power.

(c) For which frequency of the source is the power transferred to the circuit half the power at resonant frequency? What is the current amplitude at these frequencies?

21. Prove mathematically that the average power over a complete cycle of alternating current through an ideal inductor is zero. 3

22. A capacitor is connected across an a.c source. Show mathematically that the current leads the applied emf by a phase angle of $\pi/2$. What is capacitive reactance? Draw a graph showing the variation of capacitive reactance with the frequency of an a.c source. 3

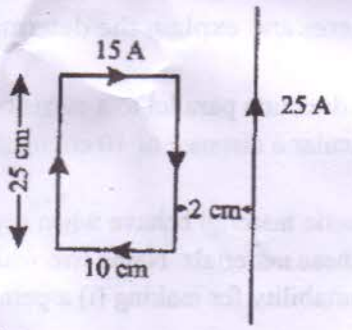
23. Vijay was preparing an electronic project for science exhibition. He required a capacitance of 2μF having a capacity to operate under 1 kV potential. He went to a shop to purchase it. Shopkeeper was having only 1μF capacitors of 400 V rating. Vijay calculated minimum number of capacitors of 1 μF so that he could arrange them to form a capacitor of 2μF value. 4

(a) What values do you judge in Vijay ?

(b) Show the calculations done by Vijay.

24. Derive an expression for the force between two straight parallel current carrying conductors of infinite length and hence define one ampere. 5

What is the direction and magnitude of the net force acting on the loop as shown in the fig.?



$I = I_0 \sin(\frac{\pi}{2} - \omega t)$

$= I_0$

$\mu_0 I / 4R$

OR

With the help of a neat and labeled diagram, explain the underlying principle, construction and working of a moving coil galvanometer. What is the function of ,

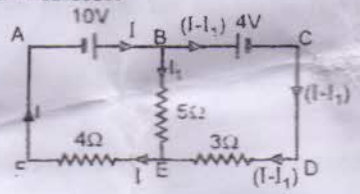
(i) Uniform radial field;
(ii) Soft iron core; in such a device.

25. Draw a labeled diagram to explain the principle and working of an a.c generator. Deduce the expression for the e.m.f generator. Can the current produced by an a.c generator be measured with a moving coil ammeter? Give reason for your answer. 5

OR

Define mutual induction. Distinguish between self-induction and mutual induction. Calculate the mutual induction of two long solenoids of same length wound over the other.

26. State kirchhoff's laws in electricity. Two batteries of 10 V and 4 V e.m.f's have been connected in the circuit as shown in the fig. find the current in each resistor. 5



OR

(a) What do you mean by drift velocity. Derive the expression of it.

(b) Define relaxation time. Derive the relation between relaxation time and resistivity.