BLUEBELLS SCHOOL INTERNATIONAL
1st TERMINAL EXAMINATION
CLASS: XII
SUBJECT: PHYSICS **M.M. 70**
TIME: 3hrs

SET A

Syllabus: Electrostatics, Current Electricity, Moving Charges, Magnetism, EMI & AC

General Instructions:

(i) *All questions are compulsory.*
(ii) *There is no overall choice. However an internal choice has been provided in all three questions of five marks. You have to attempt only one of the choices in such questions.*
(iii) *Question numbers 1 to 5 are very short answer type questions, carrying 1 mark each.*
(iv) *Question numbers 6 to 10 are short answer type questions, carrying 2 marks each.*
(v) *Question numbers 11 to 22 are also short answer type questions, carrying 3 marks each.*
(vi) *Question numbers 23 value based question, carrying 4 mark.*
(vii) *Question numbers 24 to 26 are long answer type questions, carrying 5 marks each.*

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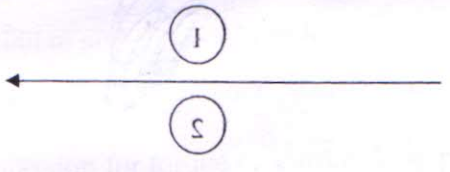
1. The emf of a cell is always greater than its terminal voltage, why? 1

2. Predict the direction of induced current in metal ring 1 and 2 lying in the same plane where current I is increasing 1



3. Define quality factor of resonance in series LCR circuit. What is its unit? 1

4. What is the force acting on a moving charge in a uniform magnetic field? When the force acting on a moving charge in uniform magnetic field is maximum? 1

5. The plates of a charged capacitor are connected by a voltmeter. If the plates of the capacitor are moved farther apart, what will be the effect on the reading of voltmeter? 1

6. Plot a graph showing the variation of Coulomb force (F) versus $1/r^2$, where r is the distance between the two charges of each pair of charges: (1μC,2 μC) and (2μC,−3μC). Interpret the graphs obtained. 2

7. A magnetising field of 1600 A m^{-1} produces a magnetic flux of 2.4×10^{-5} Wb in a bar of iron of cross-section 0.2×10^{-4} m^2. Calculate the permeability and susceptibility of the bar. 2

8. The electric field outside a long straight wire is given by: E = 1000/r Vm^{-1} and is directed outwards. If two points A and B are situated such that r_A=0.2m r_B=0.4m, find the value of $V_A - V_B$. 2

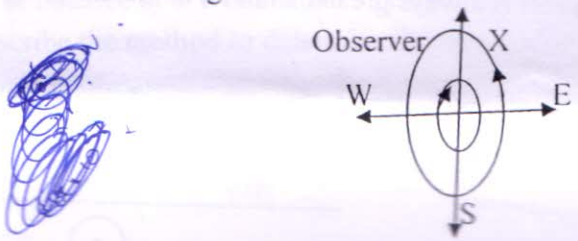
9. Show that the average power consumed in LCR series circuit is P= Erms Irms cosϕ

10. What are eddy currents? In what sense are eddy currents considered undesirable and how are these can be minimized?

11. The current flowing through an inductor of self-inductance L is continuously increasing. Plot a graph showing the variation of : 3
i. magnetic flux versus current
ii. Induced emf versus dI/dt
iii. Magnetic potential energy stored versus current.

12. Explain the three element of earths magnetic field with a diagram. 3

13. Two concentric circular coils X and Y of radii 16cm and 10cm respectively lie in the same vertical plane containing north to south direction. Coil X has 20 turns and carries a current of 16A where coil Y has 25 turns and carries a current of 18A. Find the magnitude and direction of the net magnetic field at the Centre of the coil. 3



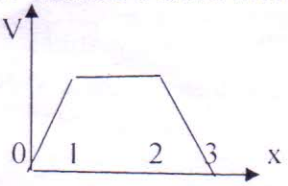
14. Derive an expression for torque on current loop placed in uniform magnetic field. What are stable and unstable equilibrium? 3

15. State its principle of working of a transformer .The primary coil of an ideal step up transformer has 100 turns and the transformer ratio is also 100.The input voltage and power are 220V and 1100 W. Calculate: i. Number of turns in the secondary 3
ii. Current in the primary iii. Voltage across secondary iv. Current in the secondary
v. Power in the secondary.

16. When an alternating voltage of 220 V is applied across a device X, a current of 0.5A flows through the circuit and is in phase with the applied voltage. When the same voltage is applied across another device Y, the same current flows through the circuit but it leads the applied voltage by π/2 radian. (i) Name the devices X and Y. (ii) Calculate the current flowing in the circuit, when same voltage is applied across the series combination of X and Y. 3

Compare the electric field and potential due to a point charge with distance x. 3

The electric potential as a function of distance x is shown in the figure. Construct a graph of electric field with distance x



18. In a meter bridge experiment, a resistor of resistance R is kept in the left gap in all the observations. When resistance R_1 & R_2 are connected in turn in the right gap, the balance point is obtained at 60cm and 50cm from zero end of the wire. Find the position of balance point, when the right gap contains R_1 and R_2 (a) in series and (b) in parallel. 3

19. Define temperature coefficient of resistivity and write its significance.Show graphically the variation of resistivity with temperature in case of (a)Copper (b)Nichrome (c)Semiconductor. 3

20. Explain the difference between diamagnetic and paramagnetic substances. 3

21. (i) Explain the effect of introducing a dielectric slab between the plates of a parallel plate 3
(ii) capacitor on the electric field within the capacitor. Hence define the dielectric constant. Write the expression for potential energy of an electric dipole in uniform electric field. Determine the potential energy of a system of two charges 7μC and −2μC with no external field placed at (− 9cm,0,0) and (9cm,0,0).

22. Define potential gradient and write its relation with electric field. A proton placed in a uniform electric field of magnitude 2000N/C moves between 2 points in the direction of electric field. If the distance between the points is 0.2m find the value of (i) p.d. between the points (ii)work done. 3

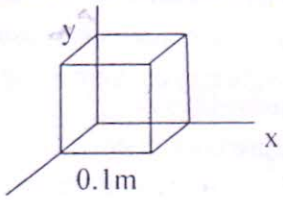
23. Abhineet's uncle was advised by his doctor to undergo MRI scan test of chest gave him an estimate of the cost. Not knowing much about the significance of this test and finding it to be too expensive he first hesitated. When Abhineet learnt about this, he decided to take help from his family and arranged for the cost. He convinced his uncle to undergo this test so as to enable the doctor to diagnose the disease. He got the test done and resulting information greatly helped the doctor to give him proper treatment. 4

(i) What according to you are the values displayed by Abhineet?

(ii) Assuming that the MRI test involved a magnetic field of 0.1T, find maximum and minimum values of the force that this field could exert on a proton moving with a speed of 10^4m/s. State the condition under which the force can be minimum.

24. (i) Using Gauss's theorem show mathematically that for any point outside the shell, the field due to a uniformly charged thin spherical shell is the same as if the entire charge of the shell is concentrated at the centre. Why do you expect the electric field inside the shell to be zero according to this theorem? 5

Electric field is directed along + x direction and is given by $E_x = 5Ax+2B$ where A & B are constants having dimensions. Take $A=10\ NC^{-1}m^{-1}$ and $B=5NC^{-1}$. Calculate the electric flux through the cube.



OR

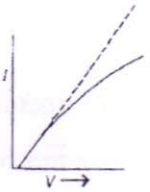
Find the expression for the electric potential due to a dipole at a point on the equatorial line. Deduce the expression for the potential energy of a system of two point charges q_1 and q_2 brought from infinity to r_1 and r_2 in uniform electric field **E.** 5

25. (i) Deduce the condition for balance in a Wheatstone's bridge. Using the principle of Wheatstone bridge, describe the method to determine the specific resistance of a wire in the laboratory. Draw a circuit diagram and write the formula used. Write any two important precautions used while performing the experiment. 5

OR

(i) Two cells of emf E_1 and E_2 have internal resistance r_1 and r_2. Deduce an expression for equivalent emf of their parallel combination. 5

(ii) The I-V characteristics of a resistor are observed to deviate from a straight line for higher values of current as shown below. Why? Plot also I-V characteristics for GaAs.



26. State Faraday's laws of electromagnetic induction. Derive an expression for the mutual inductance of two long solenoids wound over one another, in terms of their number of turns N_1, N_2, common cross sectional area A and common length L. **OR** 5

(i) A bar magnet falling under gravity through an air cored coil. Plot a graph showing the variation of induced emf with time. What does the area by the E-t curve suggest?

(ii) Obtain the expression for induced emf, force and mechanical power required to move a conductor of length *l* with uniform speed v in a direction perpendicular to its length, when a uniform magnetic field B(×) acting to the plane containing *l* and v. 5