INDIAN SCHOOL SOHAR
FIRST TERM EXAMINATION- 2014
PHYSICS – THEORY

CLASS: XII **MARKS:70**

DATE: 14/09/2014 **TIME:3 hrs**

General Instructions

- ***a. All questions are compulsory.***
- ***b. There are 26 questions in total. Questions 1 to 5 carry one mark each, questions 6 to10 carry two marks each, questions11 to 22 carry three marks each, question 23 is a value based question carrying 4 marks and questions 24 to 26 carry five marks each.***
- ***c. There is no overall choice. However, internal choice has been provided in one question of two marks, one question of three marks and all questions of five marks. You have to attempt only one of the given choices in such questions.***
- ***d. Use of calculator is not permitted.***
- ***e. You may use the following physical constants wherever necessary1***

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1. Name the part of the electromagnetic spectrum of wavelength 10^{-2} m and mention its one application. (1)

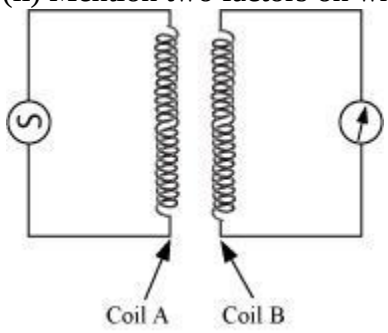
2.A 500 μC charge is at the centre of a square of side 10 cm. Find the work done in moving a charge of 10 μC between two diagonally opposite points on the square. (1)

3.Is the force acting between two point electric charges q_1 and q_2, kept at some distance apart in air, attractive or repulsive, when (i) $q_1q_2 > 0$ (ii) $q_1q_2 < 0$? (1)

4. Arrange the following electromagnetic waves in decreasing order of wavelength:
Gamma- rays, infrared rays, X-rays and microwaves. (1)

5. Plot a graph showing the variation of resistance of a conducting wire as a function of its radius, keeping the length of the wire and its temperature as constant. (1)

6. The circuit arrangement given below shows that when an a.c. passes through the coil A, the current starts flowing in the coil B.
(i) State the underlying principle involved.
(ii) Mention two factors on which the current produced in the coil B depends. (2)



7. How is the mutual inductance of a pair of coils affected when:
(i) Separation between the coils is increased?
(ii) The number of turns of each coil is increased?
(iii) A thin iron sheet is placed between the two coils, other factors remaining the same?
Explain your answer in each case. (2)

8. Describe the domain theory of ferromagnetic substances .Name its types with examples.

OR

8. Name two elements, one having positive susceptibility and the other having negative. (2)

susceptibility. What does negative susceptibility signify?

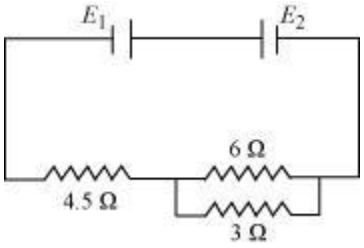
9. The oscillating magnetic field in a plane electromagnetic wave is given by

$$B_y = \left(8\times10^{-6}\right)\sin\left[2\times10^{11}t + 300\pi x\right] \text{ T}$$

(i) Calculate the wavelength of the electromagnetic wave.

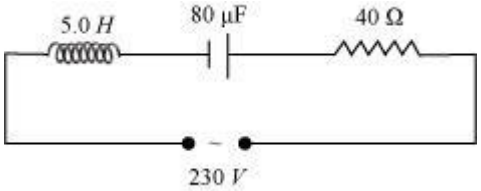
(ii) Write down the expression for the oscillating electric field. (2)

10.Two cells E_1 and E_2 in the given circuit diagram have an *emf* of 5 V and 9 V and internal resistance of 0.3 Ω and 1.2 Ω respectively. Calculate the value of current flowing through the resistance of 3 Ω.



(2)

11.The given circuit diagram shows a series *LCR* circuit connected to a variable frequency 230 V source.



(a) Determine the source frequency which drives the circuit in resonance.

(b) Obtain the impedance of the circuit and the amplitude of current at the resonating frequency.

(c) Determine the rms potential drops across the three elements of the circuit.

OR

The primary coil of an ideal step-up transformer has 100 turns and the transformation ratio is also 100. The input voltages and the power are 220 V and 1100 W respectively. Calculate:

(i) Number of turns in the secondary

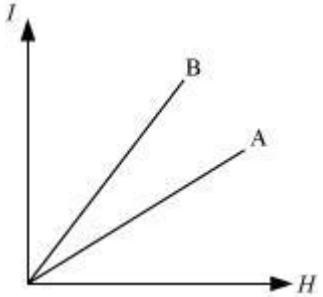
(ii) The current in the primary

(iii) Voltage across the secondary

(iv) The current in the secondary

(v) Power in the secondary (3)

12.The following figure shows the variation of intensity of magnetisation versus the applied magnetic field intensity, H_j for two magnetic materials A and B:



(a) Identify the materials A and B.

(b) Why does the material B have a larger susceptibility than A for a given field at constant temperature? (3)

13.With the help of a neat and labelled diagram, explain the underlying principle and working of a moving coil galvanometer. What is the function of(i) Uniform radial field(ii) Soft iron core in such a device? (3)

14.Derive a mathematical expression for the force per unit length experienced by each of the two long current carrying conductors placed parallel to each other in air. Hence define one ampere of current. (3)

15.(i)Draw equipotential surfaces for uniformly increasing electric field . Justify .

(ii) Two charges −q and +q are located at points A (0, 0, −a) and B (0, 0, +a) respectively. How much work is done in moving a test charge from point P (7, 0, 0) to Q (−3, 0, 0)? (3)

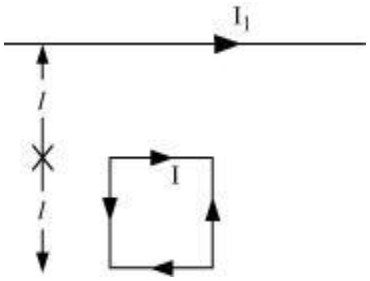
16.How does a charge q oscillating at certain frequency produce electromagnetic waves? Sketch a schematic diagram depicting electric and magnetic fields for an electromagnetic wave propagating along the X-direction. (3)

17. (a) Define self inductance. Write its S.I. units.

(b) Derive an expression for self inductance of a long solenoid of length l, cross-sectional area A having N number of turns. (3)

18.Write the expression for the magnetic moment $(\vec{m})$ due to a planar square loop of side '*l*' carrying a steady current I in a vector form.

In the given figure this loop is placed in a horizontal plane near a long straight conductor carrying a steady current I_1 at a distance l as shown. Give reason to explain that the loop will experience a net force but no torque. Write the expression for this force acting on the loop. Also write the kind of force. Justify your answer. (3)

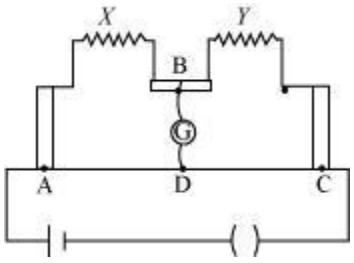


19.Explain the behaviour of para and dia magnetic substances kept in uniform magnetic field with the help of diagram. (3)

20.Explain the principle and working of a cyclotron with the help of a schematic diagram. Write the expression for cyclotron frequency. (3)

21.Two metallic wires of the same material have the same length but cross-sectional area is in the ratio 1:2. They are connected (i) in series and (ii) in parallel. Compare the drift velocities of electrons in the two wires in both the cases (i) and (ii). (3)

22.The figure shows experimental set up of a meter bridge. When the two unknown resistances X and Y are inserted, the null point D is obtained 40 cm from the end A. When a resistance of 10 Ω is connected in series with X, the null point shifts by 10 cm. Find the position of the null point when the 10 Ω resistance is instead connected in series with resistance 'Y'. Determine the values of the resistances X and Y. (3)



23. Kamal's uncle was advised by his doctor to undergo an MRI scan test of his chest and gave him an estimate of cost. Finding it expensive Kamal's uncle hesitated to do the test. When Kamal learnt about this he decided to help his uncle for arranging 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.

(a) What , according to you, are the values displayed by kamal?

(b) Assuming that the MRI scan test involved a magnetic field of 0.1T, find the maximum and the 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. (4)

24. What is electric flux? Write its S.I. units. Using Gauss's theorem, deduce an expression for the electric field at a point due to a uniformly charged infinite plane sheet.

Two point charges $q_1 = 10 \times 10^{-8}$ C and $q_2 = -2 \times 10^{-8}$ C are separated by a distance of 60 cm in air.

(i) Find at what distance from the 1st charge, q_1, would the electric potential be zero.

(ii) Also calculate the electrostatic potential energy of the system.

OR

24.Derive an expression for potential due to an electric dipole.

Two point charges $4Q$, Q are separated by 1 m in air. At what point on the line joining the charges is the electric field intensity zero? Also calculate the electrostatic potential energy of the system of charges, taking the value of charge, $Q = 2 \times 10^{-7}$ C. (5)

25.Describe briefly, with the help of a labelled diagram, the basic elements of an A.C. generator. State its underlying principle. Show diagrammatically how an alternating emf is generated by a loop of wire rotating in a magnetic field. Write the expression for the instantaneous value of the emf induced in the rotating loop.

OR

25. Define the term mutual inductance. Deduce the expression for the mutual inductance of two long coaxial solenoids having different radii and different number of turns.

A magnetic field of flux density 10 T acts normal to a coil of 50 turns having 100 cm^2 area. Find emf induced if the coil is removed from the magnetic field in 0.1 sec. (5)

26.A series LCR circuit is connected to a source having voltage $v = v_m \sin \omega t$. Derive the expression for the instantaneous current I and its phase relationship to the applied voltage. Obtain the condition for resonance to occur. Define 'power factor'. State the conditions under which it is (i) maximum and (ii) minimum.

OR

26.A inductor is connected in series to a a.c. source. Derive an expression for the current produced. Draw its phasor diagram along with its graphical representation.

Show how the power dissipated by a inductor is zero. (5)