QUESTION BANK
ELECTRO MAGNETIC EQUATION

LEVEL A

1) Define Magnetic flux. Write its Unit. 1
2) Define Henry 1
3) Write two applications of eddy currents. 1
4) State faraday's Laws of EM induction 1
5) Write Lenz's Law 1
6) How Eddy currents are generated? How it can be minimized? 2
7) Derive the relation for the self-inductance of coil of Length l 2
8) Derive expression for the energy stored across the inductor. 2
9) Current in a circuit falls from 5 A to 0A in 0.1 s . If an average emf of 200V induced, give an estimate of the self-inductance of the circuit 2
10) Show that $M_{12} = M_{21}$ 2
11) Two concentric circular coils, one of small radius r_1 and other of large radius r_2 such that $r_1 <<< r_2$ are placed co-axially with centers coinciding. Obtain mutual inductance of the arrangement. 3
12) Derive the relation for motional electromotive force. 3
13) Obtain the expression for ther magnetic energy stored in a solenoid in terms of magnetic field B, area A and length l of the solenoid. How does this magnetic energy compare with electro static energy store in a capacitor. 3
14) Write the Principle construction and working of a AC generator with necessary mathematical relations and labeled diagram. Also draw the wave form of AC. 5
15) A metallic rod of 1m length is rotated with a frequency of 50 rev/ s, with one end hinged at the center and other end at the circumference of a circular metallic ring of radius 1 m about an axis passing through the center and perpendicular to the plane of the ring. A constant and uniform magnetic 1T parallel to the axix is prte3sent everywhere. What is the emf between the center and the metallic ring 5

Level B

1) Induced emf is also called back emf. Why? 1
2) A wire kept along east west direction is allowed to fall freely. Will an emf be induced across the ends of the wire? 1
3) Will an induced emf develop in a conductor, when moved in a direction parallel to the magnetic field? 1
4) How does the self-inductance of the coil change when an iron rod is introduced in it? 1
5) Magnetic flux of 5 micro weber is linked with a coil, when a current of 1 mA flows through it. What is the self-inductance of the coil? 1
6) Self-induction is called the inertia of the electricity. Why? 1
7) Why are the resistance coils double wound? 1
8) Write two differences between self-inductance and mutual inductance. 2
9) A pair of adjucant coils has a mutual inductance of 1.5 H. If the current in one coil 2changes from 0 to 20 A in .5 s. What is the change of the flux linkage with the other coil? 2
10) If the speed of the rotation of the armature of a generator is increased, how would it affect the maximum emf produced. 2
11) A 1.0 m long metallic rod is rotaded with an angular frequency of 400 rad/s about an axis normal to the rod passing through its one end. The other end of the rod is in contact with a circular metallic ring. A constant and uniform magnetic field of 0.5 T parallel to the axis exists everywhere. Calculate the emf developed between the center and the ring 3
12) 3.In a given circuit, inductor L and resistor R have identical resistance. Two similar electric lamps B 1 and B 2 are connected as shown. When switch S is closed, (i) which one of the lamps lights up earlier, (ii) will the lamps be equally bright after some time? Justify your answer. 3
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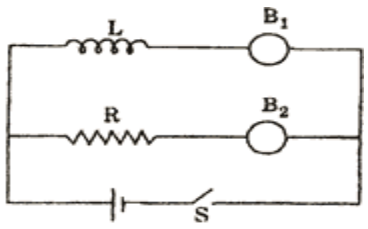
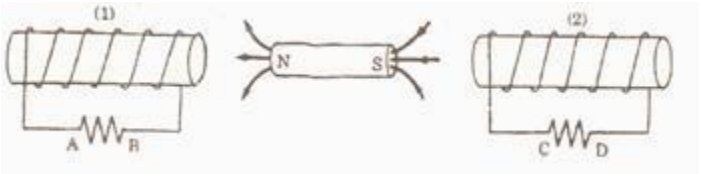
14) In a given circuit, inductor L and resistor R have identical resistance. Two similar electric lamps B_1 and B_2 are connected as shown. When switch S is closed, (i) which one of the lamps lights up earlier, (ii) will the lamps be equally bright after some time? Justify your answer. 3



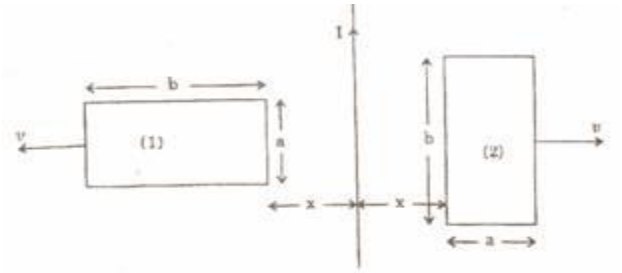
15) In the figure given below, a bar magnet moving towards the right or left induces an e.m.f. in the coils (1) and (2). Find giving reason, the directions of the direction of the induced currents through the resistors AB and CD when the magnet is moving (a) towards the right, and (b) towards the left. 3



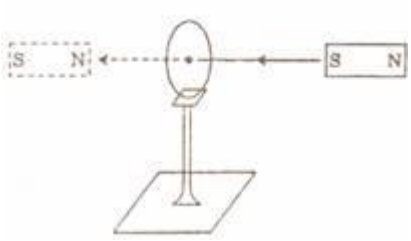
LEVEL C

1. The figure shows two identical rectangular loops (1) and (2), placed on a table along with a straight long current carrying conductor between them.

(i) What will be the directions of the induced currents in the loops when they are pulled away from the conductor with same velocity U?
(ii) Will the e.m.f. induced in the two loops be equal? Justify your answer. 3



2. Give the direction in which the induced current flows in the coil mounted on an insulating stand when a bar magnet is quickly moved along the axis of the coil from one side to the other as shown in the fig.



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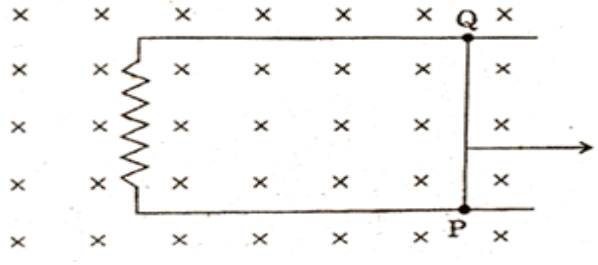
3. How is the mutual inductance of a pair of coils affected when: (i) separation between the coils is increased?
(ii) the number of turns of each coil is increased ?
(iii) a thin iron sheet is placed between the two coils, other factors remaining the same? Explain your answer in each case. 3

4. A square loop has 100 turns, an area 2.5 X 10^{-3} m^2 and a resistance of 100 ohm. The perpendicular magnetic field has a magnitude of 0.4 T if the loop is slowly and uniformly pulled out of the field in 1 s , find the work done. 3

5. A long solenoid of 10 turns per cm has a small loop of area 1 sq. cm placed inside with the normal of the loop parallel to the axis. Calculate the Voltage across the small loop if the current in the solenoid is changed from 1 A to 2A in 0.1 s, during duration of the change. 3

6. . A 0.5 long metal rod PQ completes the circuit as shown in the figure. The area of the circuit is perpendicular to the magnetic field of flux density 0.15 T. If the resistance of the total circuit is 3Ω, calculate the force needed to move the rod in the direction as indicated with a constant speed of 2 ms^1.



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7. State Lenz's law. Two identical loops, one of cooper and the other of aluminum are rotated with the same speed, in a uniform magnetic field acting normal to the plane of the loops. State with reason, for which of the coils (i) induced e.m.f., (ii) induced current, will be more 3

8. A transformer having efficiency 90% is working on 100V and at 2.0KW power.If the current in the secondary coil is 5A. Calculate (i) the current in the primary (ii) Voltage across the secondary coil. 3