ELECTROMAGNETIC INDUCTION AND ALTERNATING CURRENT

1. A choke coil and a bulb are connected inseries to a d.c source.The bulb shines brightly .How does the brightness change when an iron core is inserted in the choke coil?
2. A vertical magnetic poles falls down through the plane of the magnetic meridian.Will any e.m.f be produced between its ends? Give reason for your answer.
3. Power factor of an ac circuit is 0.5. What will be the phase difference between voltage and current in the circuit?
4. Which device will you use to step up/ step down a.c voltage?
5. The e.m.f of ac source is given by the expression $E = 300 \sin 314\ t$ volts. Write the values of an peak voltage and frequency of source.
6. Which is the best method of reducing current in an a.c circuit and why?
7. Write expression for the average value of the a.c voltage $V = V_o \sin\omega t$ over the time interval $t = 0$ and $t = \pi/\omega$.
8. An electrical element X, when connected to an alternating voltage source, has the current through it leading the voltage by $\pi/2$ rad. Identify X and write an expression for its reactance.
9. State Faraday's laws of electromagnetic induction.
10. State Lenz law .Show that Lenz law follows from principle of conservation of energy.
11. Draw the graphs showing the variation of reactance of (a) a capacitor and (b) an inductor with the frequency of an a.c. circuit.
12. Derive an expression for induced e.m.f produced by changing the area of a rectangular coil placed perpendicular to the magnetic field.
13. Derive an expression for the instantaneous value of induced e.m.f in a coil when it is rotated in a uniform magnetic field at a uniform angular velocity .How does the e.m.f vary when the coil rotates through an angle of 2π ?

    (OR)

    A 44 mH inductor is connected to 220 V, 50 Hz A.C supply.
    Determine the r.m.s value of current in the circuit.
14. How are eddy currents produced? Give two applications of eddy currents.
15. Derive expression for the self inductance of a long solenoid of length having N turns.
16. A radio frequency choke is air cored coil whereas an audio frequency choke is iron cored. Give reasons for this difference.
17. Define Mutual induction. Write its S.I unit. Give two factors on which the coefficient of mutual inductance between a pair of coils depends.
18. The magnetic flux through a coil perpendicular to its plane is varying according to the relation $\Phi = (5\ t^3 + 4\ t^2 + 2t\ -5)$ weber. Calculate the induced current through the coil at $t = 2$ s of the resistance of the coil is 5Ω.
19. Derive an expression for average power consumed in an ac circuit over a complete cycle.
20. Distinguish between reactance and impedance. Sketch the graph showing the variation of impedance of LCR circuit with the frequency of applied voltage.
21.
    (i) A lamp is connected in series with a capacitor. Predict your observations for dc and ac connections. What happens in each case if the capacitance of the capacitor is reduced?
    ii) A 15 .0 μF capacitor is connected to a 220V, 50HZ source. Find the capacitive reactance.
22. A circuit containing a 80 mH inductor and a 60 μF capacitor in series is connected to a 230 V, 50 Hz supply. The resistance of the circuit is negligible. (a) Obtain the current amplitude and rms values. (b) Obtain the rms values of potential drops across each element.(c) What is the average power transferred to the inductor ?
23. Explain the basic principle, description and working of a.c generator with neat labeled diagram.
24. A rectangular coil of N turns and area of cross section A, is held in time varying magnetic field given by $B = B_0 \sin \omega t$, with plane of coil normal to the magnetic field .Deduce an expression for the e.m.f induced in the coil.

    (OR)

A wheel with 10 metallic spokes each 0.5 m long is rotated with a speed of 120 rev/min in a plane normal to the horizontal component of earth's magnetic field at a place. If B_H = 0.4 G at the place .What is the induced emf between the axle and the rim of the wheel?

25. Two circular coils, one of radius r and the other are placed coaxially with their centre coinciding. For R>>r, obtain an expression for the mutual inductance of the arrangement.

26. A pure conductor is connected across an a.c source. Show mathematically that the current in it lags behind the applied emf by a phase angle of $\pi/2$.What is the inductive reactance?

27. Derive the expression for magnetic energy stored in a inductor/ solenoid.

28. Explain the LCR circuit with neat diagram. State the condition under which the phenomenon occurs in a series LCR circuit. Plot a graph showing variation of current with frequency of a.c source in a series LCR circuit.
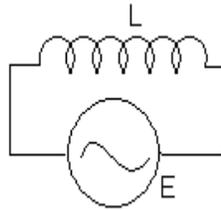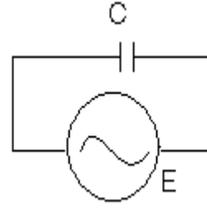   How does the impedance of an LCR series circuit varies with the frequency of a.c?

(OR)

(i) Figure (a), (b) and (c) Show three alternating circuits with equal currents.
   If frequency of alternating emf be increased, what will be the effect on
   currents In the three cases. Explain
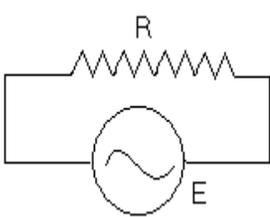
(a)	(b)	(c)

(ii) Does the current in an A.C. circuit lag, lead or remain in phase with the
    Voltage of frequency ν □applied to the circuit when
    (i) ν □= ν_r (ii) □ $\nu < \nu_r$ (iii) ν □> ν_r where □r is the resonance frequency.

29. Describe the principle, construction and working of a transformer. Why
    is the core of the transformer laminated? Explain the power losses.
    Give the remedies.

(OR)

(i) What is self inductance? Deduce an expression for the self
   Inductance of a long solenoid of N turns, having a core of relative
   Permeability μr.
(ii) How does the self inductance of an air core coil change, when
                (a) the number of turns in the coil is decreased ,
                (b) an iron rod is introduced in the coil ?

30. (a) A capacitor is connected across an a.c source. Show
    Mathematically that the current in it lags behind the applied emf by
    a phase angle of $\pi/2$.What is the inductive reactance
   (b) Briefly describe how electrical power is transmitted from a power
      house to a substation and eventually used by the consumers.

(OR)

(a) Define Mutual induction. Write its S.I unit.
(b) Derive an expression for the mutual inductance of two long coaxial solenoids of same length wound one
    over the other.
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