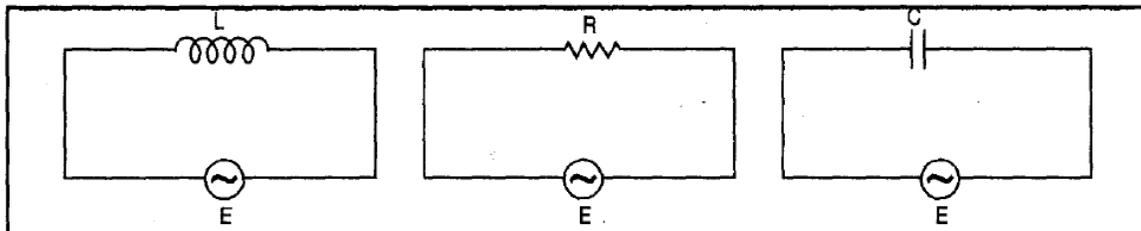


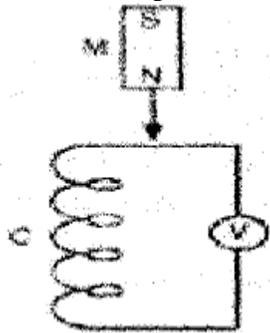
E. M. INDUCTION & A.C. CIRCUITS.

1. A small resistor is usually put in parallel to the current carrying coil of an electromagnet. What purpose does it serve?
2. 11 kilowatts of power can be transmitted in two ways, (i) 220 volts at 50 amperes and (ii) 22000 volts at 0.5 amperes. Which is economical? Give reasons for your choice.
3. When a cyclist pedals fast, light becomes brighter. Why?
4. A coil and a bar magnet move with same velocity. What will be the induced e.m.f in the coil?
5. A lamp connected in parallel with large inductor glows brilliantly before going off, when the switch is put off. Why?
6. Figure (a), (b) and (c) show three a.c. circuits in which equal currents are flowing. If the frequency of emf be increased, how will the current be affected in these circuits? Give reason for your answer.



An a.c. circuit consists of a series combination of circuit elements 'X' and 'Y'. The current is ahead of the voltage in phase by $\pi/4$. If element 'X' is a pure resistor of 100Ω . (i) name the circuit element 'Y', and (ii) calculate the rms value of current, if rms value of voltage is 141 V.

9. Figure shows a bar magnet M falling under gravity through an air cored coil C. Plot a graph showing the variation of induced e.m.f (e) with time (t). What does the area enclosed by the E - t curve depict ?



7. Determine the e.m.f induced in a 0.01H inductor when the current is changing in it at the rate of 100A/s .
8. A series LCR circuit with $L = 0.12\text{H}$, $C = 4.8 \times 10^{-7}\text{F}$, $R = 23\Omega$ is connected to a variable power supply. At what frequency is the current maximum?
9. A circuit containing a 20Ω resistor and a 0.1F capacitor in series is connected to a 230V supply of angular frequency 100rad/s . What is the impedance of the circuit?
10. At what frequency will a 2H inductor have a reactance of 400Ω ?
11. A series LCR circuit with $L = 5\text{H}$, $C = 80\text{F}$ and $R = 40\text{ohm}$ is connected to a variable frequency source of 230V . (i) Determine the resonance frequency of the circuit (ii) Obtain the impedance of the circuit and amplitude of the current at resonance.
12. An 80V , 800W heater is to be operated on a 100V , 50Hz supply. Calculate the inductance of the choke required.
13. A 100V , 50Hz a.c source is connected to a series combination of an inductance of 0.4H and a resistance of 25Ω . Calculate the magnitude and phase of the current.
14. A current of 1.1A flows through the coil when connected to a 110V d.c. When a 110V a.c is applied to the same coil, only 0.5A current flows. Calculate the (i) resistance (ii) impedance and (iii) inductance of the coil.
15. A capacitor, a 15Ω resistor and 80mH inductor are placed in series with a 50Hz a.c.source. Calculate the capacity of the capacitor if the current is observed in phase with the voltage.
16. A capacitor of 50pF is connected to an a.c.source of frequency 1kHz . Calculate its reactance.
17. A circuit draws a power of 550W from a source of 220V , 50Hz . The power factor of the circuit is 0.8 . The current in the circuit lags behind the voltage. Show that a capacitor of about $1/4\pi \times 10^{-2}\text{F}$ will have to be connected in the circuit to bring its power factor to unity.

18. A $100 \mu\text{F}$ capacitor is charged with a 50V source supply. Then the source supply is removed and the capacitor is connected across an inductance, as result of which 5A current flows through the inductance. Calculate the value of the inductance.
19. A virtual current of 4A flows in a coil when it is connected in a circuit having alternating current of frequency 50Hz . Power consumed in the coil is 240W . Calculate the inductance of the coil if the virtual potential difference across it is 100V .
20. A series LCR circuit with $L = 0.12\text{H}$, $C = 480\text{nF}$ and $R = 23\Omega$ is connected to a 250V variable frequency supply. (a) what is the source frequency for which the current amplitude is maximum? Obtain the maximum value of current. (b) what is the source frequency for which the average power absorbed by the circuit is maximum? Obtain the maximum value of power. (c) For which frequencies of the source is the power transferred to the circuit is half the power at resonant frequency? What is the current amplitude at these frequencies?
21. An a.c source of 100V r.m.s, 50Hz is connected across a 20 ohm resistor and a 2mH inductor in series. Calculate the impedance of the circuit and the r.m.s current in the circuit.
22. In a series LCR circuit, the voltage across an inductor, capacitor and resistor are 20 V , 20 V and 40 V respectively. What is the phase difference between the applied voltage and the current in the circuit?
23. What is the power dissipated in an a.c. circuit in which voltage and current are given by
 $V = 230 \sin(\omega t + \pi/2)$ $I = 10 \sin \omega t$?
24. Mention the factors on which the resonant frequency of a series LCR circuit depends. Plot a graph showing variation of impedance of a series LCR circuit with the frequency of the applied a.c. source.
25. A bulb and a capacitor are connected in series to an a.C. source of variable frequency. How will the brightness of the bulb change on increasing the frequency of a.c? Give reason.
26. The electric mains in a house is marked as 220V , 50 c.p.s . Write down the equation for the instantaneous voltage.
27. Find the virtual current through a capacitor of capacitance 10-microfarad , when connected to a source of 110V at 50Hz supply. What is its reactance?
28. A coil of inductance $4/\pi$ henry is joined in series with a resistance of 30 Ohms . Calculate the current flowing in the circuit, when connected to a.c mains of 200V and frequency of 50Hz .
29. When 100V D.C. is applied across a coil, a current of 1A flows through it. When 100V a.c at 50Hz is applied to the same coil, only 0.5A current flows. Calculate the resistance, the impedance and the inductance of the coil.
30. A coil of inductance of 0.50H and resistance 100 ohms is connected in a 240V , 50Hz supply.
 - (a) What is the maximum current in the coil?
 - (b) What is the time lag between the voltage maximum and current maximum?
31. A 25 microfarad capacitor, 0.1 henry inductor and a 25 ohm resistor are connected in series with a source, whose emf is given by $E = 310 \cos 314t$ volt. Find (a) frequency of the e.m.f? (b) The reactance of the circuit? (c) The impedance of the circuit? (d) The current in the circuit (e) phase angle of the current by which it leads or lags the applied e.m.f? (f) The expression for the instantaneous values of current in the circuit (g) effective voltage across the capacitor, inductor and resistor and (h) the value of inductance that will make the impedance of the circuit minimum?
32. Find the power consumed in a circuit having a resistance of 30 ohm in series with an inductance of 40 ohms in series with an a.c with peak current of 1A and peak voltage of 220V .
33. A circuit consists of a non-inductive resistance of 50 ohms . An inductance of 0.3H and a capacitance of 40 microfarad in series and supplied with a current of 200V , 50Hz . Find the impedance and power in the circuit.
34. A 20 W , 50 V filament is connected in series to an a.c mains of 250V and 50Hz . Calculate the value of the capacitor required to run the lamp.
35. A 60V , 10W lamp is to be run on 100V , 60Hz a.c mains. Calculate (1) the inductance of the choke required, (2) if the resistance is to be used instead of choke, what will be its value? What will be the disadvantage in the latter case?
36. A radio frequency choke is air-cored while an audio frequency choke is iron-cored. Why?