Growth & Decay of Current in LR circuit

1. A coil has an inductance of 1·5 H and a resistance of 0·6 ohm. If the coil is connected across a 12 V battery, find the time required for the current to rise to 0·63 of its steady value. Also find the final current through the coil. [**Ans.** 2·49 s, 20 A]
2. A coil of inductance 50 H is connected to the battery of *e.m.f.* 2 V through a resistance of 10 ohm. What is the time constant of this circuit and also calculate the maximum value of current through the circuit ? [**Ans.** 5 s, 0·2 A]
3. The time constant of an inductance coil is 3·0 ms. when 100 ohm resistance is connected in series with the coil, the time constant reduces to 0·5 ms. Calculate the inductance and resistance of the coil. [**Ans.** 60 mH ; 20 Ω]
4. A 5 volt battery of negligible internal resistance is applied to a coil of inductance 1·0 H and of resistance 1·0 ohm. Calculate the time required by the current to attain a value half that of the steady state. [**Ans.** 0·6931 s]
5. A 20 mH coil is connected in series with a 2000 ohm resistor and a 12-V battery. Calculate the time constant of the circuit. After what time the current attains 99% of its final value after the switch is closed ? [**Ans.** 10 μs ; 46·06 μs]
6. A coil of resistance 50 Ω is connected across a 5·0 V battery, 0·1 s after the battery is connected, the current in the coil is 60 mA. Calculate the inductance of the coil. [**Ans.** 5·5 H]
7. An inductor of inductance 500 mH is connected in series with a resistance of 25 Ω and a battery of *e.m.f.* 5 V. Find the potential difference across the resistor after 20 ms. [**Ans.** 3·16 V]

Charging and Discharging of a capacitor through resistor

8. A capacitor of 1 μF discharges through 1 mega ohm resistance. Calculate *(i)* the time constant of the circuit *(ii)* the time during which half of the charge is left on the plate. [**Ans.** *(i)* 1 s *(ii)* 0·693 s]
9. A capacitor of 2 μF and a resistor of resistance R are connected in series with a 200 V d.c. supply. Across the capacitor a lamp is connected that glows at 120 V. Calculate the value of R to make the lamp glow 5 second after switch has been closed. [**Ans.** $2{\cdot}73 \times 10^6$ ohm]
10. A capacitor is charged through a resistance of 2 mega-ohm. If it takes 0·5 s for the charge to reach three quarters of its final value, what is the capacitance of the capacitor. [**Ans.** 0·18 μF]
11. A capacitor of 1·0 μF is connected in series with a resistance of 10^4 ohm and a battery of 2·0 volt. Find *(i)* the maximum value of current and *(ii)* the current after 0·02 s. [**Ans.** 2×10^{-4} A ; 27 μA]
12. A capacitor of 1 μ*f* is placed in series with a resistor of resistance 2 mega-ohm and a battery of *e.m.f.* of 2 volt. Calculate the time after which the charge will grow to 86·47% of its maximum value. [**Ans.** 4·0 s]
13. A charged capacitor is connected across a 10 kΩ resistor and allowed to discharge. The potential difference across the capacitor drops to 37% of its original value after a time of 7 s. Calculate the capacitance of capacitor. [**Ans.** 704 μF]

Alternating current, e.m.f. or voltage

14. Write the general equation for the instantaneous *e.m.f.* or voltage of a 50 Hz generator whose peak voltage is 270 volt. [**Ans.** $V = 270 \sin 100 \pi t$]
15. The equation of an alternating current is $I = 50 \sin 400 \pi t$. What is the r.m.s. value of current and its frequency ? [**Ans.** 35·36 A, 200 Hz]
16. If the effective value of a.c. mains supply is given to be 220 volt, what would be the average voltage during the positive half cycle ? [**Ans.** 198·16 V]