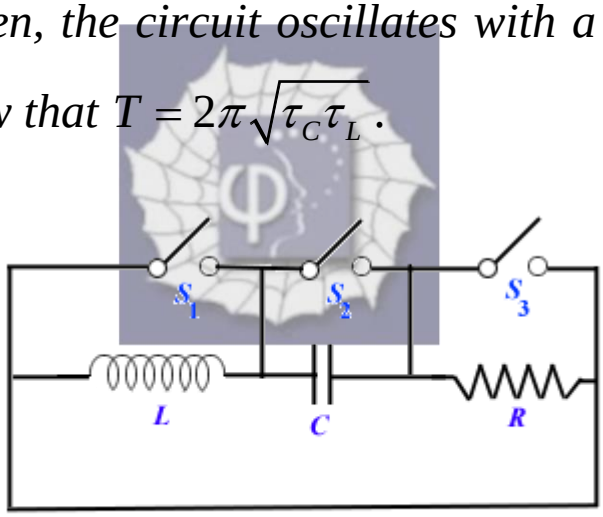
526.

Problem 38.49 (RHK)

Let us consider the circuit as shown in the figure. With switch S_1 *closed and the other two switches open, the circuit has a time constant* τ_C. *With switch* S_2 *closed and the other two switches open, the circuit has time constant* τ_L. *With switch* S_3 *closed and the other two switches open, the circuit oscillates with a period T. We have to show that* $T = 2\pi\sqrt{\tau_C \tau_L}$.



Solution:

In the circuit shown in the figure when The switch S_1 is closed and the other two switches are kept open, the circuit reduces to an RC . Therefore, its time constant $\tau_C = RC.$

When the switch S_2 is closed and the other two switches are kept open, the circuit reduces to a *LR* with time constant

$$\tau_L = \frac{L}{R}.$$

When the switch S_3 is closed and the other two switches are kept open, the circuit reduces to a *LC*. It is an oscillatory circuit with period

$$T = 2\pi\sqrt{LC}.$$

As

$$\tau_C \tau_L = LC,$$

$$T = 2\pi\sqrt{\tau_C \tau_L}.$$