Tutorial Sheet

1. The waveform shown in Fig.1 has a time period of $10s$.

   (a) What is the average value of the current over the one period?

   (b) How much charge is transferred in the interval $1 < t < 12s$?

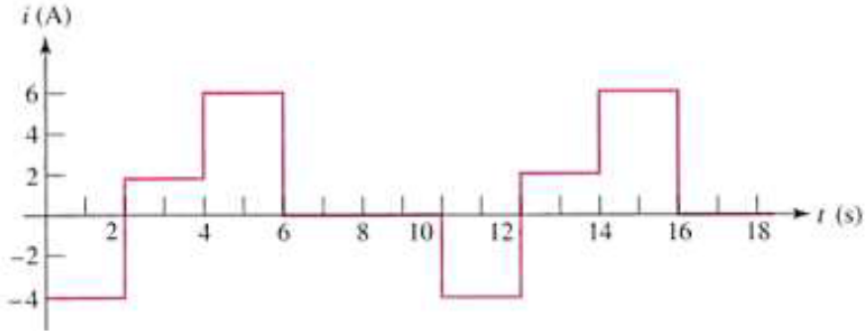

Fig. 1

2. Consider the circuit shown in Fig.2. The steady state is reached when switch S is open. If S is closed at $t = 0$, the voltage across the inductor L at $t = 0^+$ will be?
3. For the circuit shown if Fig.3, the current $i(t)$ and voltage $v_L(t)$ are given as:

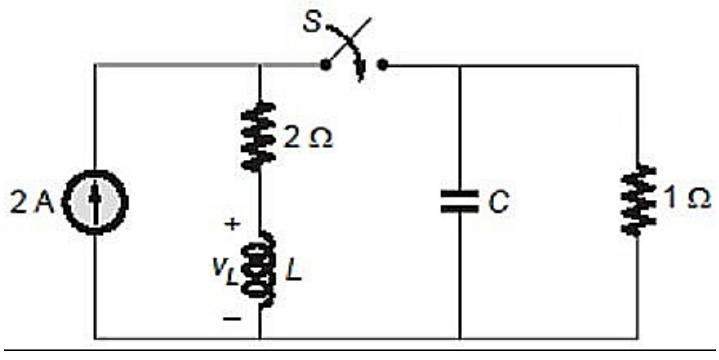

Fig. 2

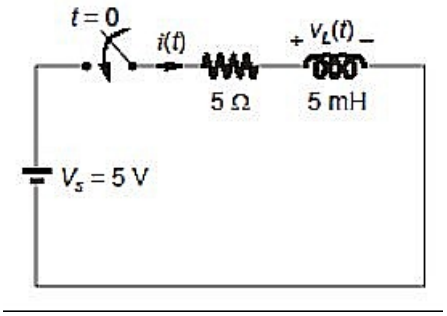

Fig. 3

$$i_L(t) = A\left(1 - e^{-Bt}\right) u(t)A,$$
$$v_L(t) = Ce^{-Bt}u(t)V$$

Find the value of $\frac{AB}{C}$.

4. Consider the Fig.4. If $5\mu F$ capacitor is initially charged with $500\mu C$,all other capacitors are initially relaxed and switch is closed at $t = 0$, then find the voltage drop $v_R(t)$ across 10Ω resistor at $t = 5\mu s$.

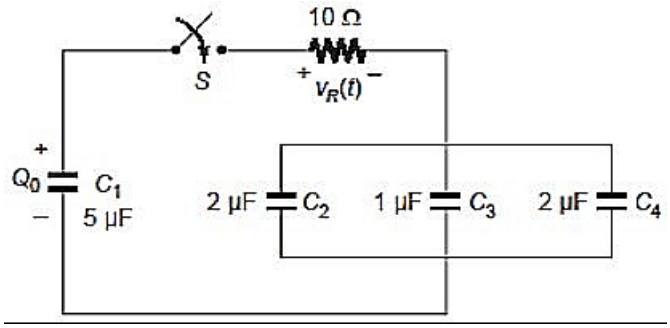

Fig. 4

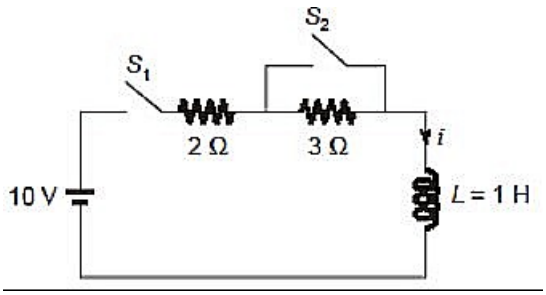

Fig. 5

5. For the circuit in Fig.5, switch S_1 and S_2 are open for a long time. At $t = 0$, S_1 is closed, while S_2 is open. At $t = 2s$, S_2 is also closed. Find the value of current i at $t = 3s$.
6. In Fig.6, consider the switch is at position '1' for a long time and at $t = 0$ it is moved to position

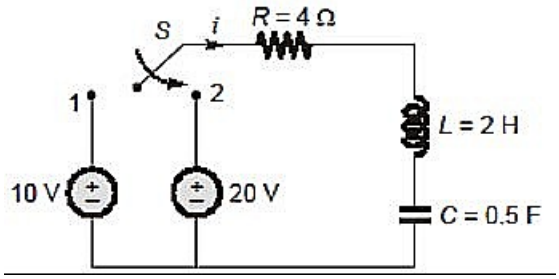

Fig. 6

'2'. Find the current $i(t)$ for $t > 0$.

7. A parallel RLC circuit has *L=2H* and *C=0.25F*. Find the value of *R* that will produce critical damping factor.
8. The branch current in an *RLC* circuit is described by the differential equation

$$\frac{d^2i}{dt^2} + 6\frac{di}{dt} + 9i = 0,$$

and the initial condition are $i(0) = 0, \frac{di(0)}{dt} = 4$. Obtain the characteristic equation and determine $i(t)$ for $t > 0$.

9. (a) Obtain $v(t)$ for $t > 0$ for the circuit shown in Fig.7.
   (b) Calculate $v(t)$ for $t > 0$ for the circuit shown in Fig. 8.

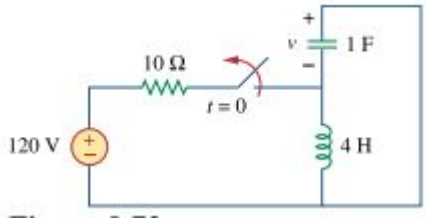

Fig. 7

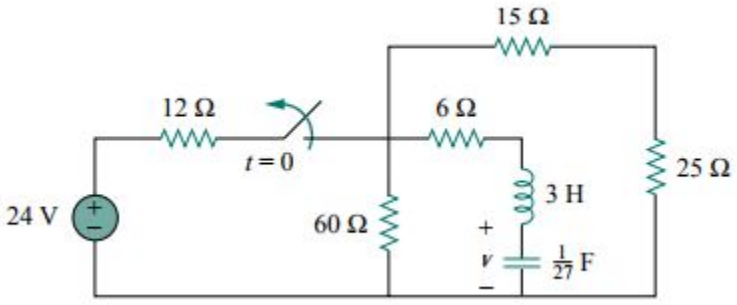

Fig. 8

10. The response of a series RLC circuit are,

$$v_c(t) = 30 - 10e^{-20t} + 30e^{-10t}V$$
$$i_L(t) = 40e^{-20t} - 60e^{-10t}mA,$$

where v_c and i_L are the capacitor voltage and inductor current, respectively. Determine the values of R, L, C.

11. In the circuit shown in Fig.9, find and i_0,v_0 and i for all time, assuming that the switch was open for a long time.

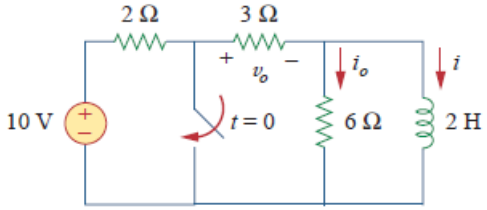

Fig. 9

12. The switch in the circuit of Fig.10 has been closed for a long time. At $t = 0$ the switch is opened. Calculate $i(t)$ for $t > 0$.

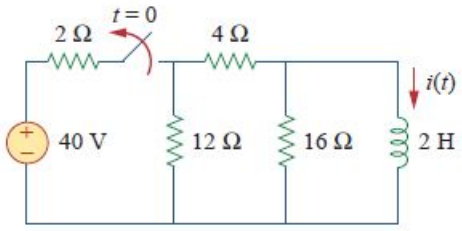

Fig. 10

13. The switch in Fig.11 has been in position A for a long time. At $t = 0$, the switch moves to B. Determine the of voltage at $t = 1s$ and $4s$.

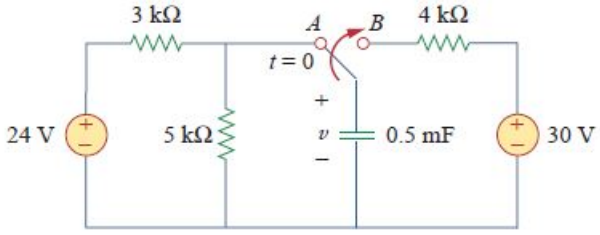

Fig. 11

14. Find $i(t)$ in the circuit of Fig.12 for $t > 0$. Assume that the switch has been closed for a long time.

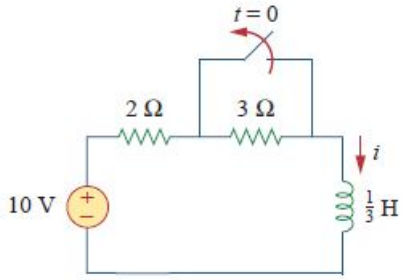

Fig. 12

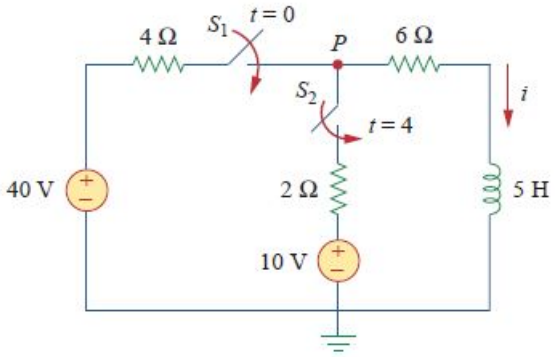

Fig. 13

15. At $t = 0$, S_1 in Fig.13 is closed, and S_2 is closed $4s$ later, find $i(t)$ for $t > 0$. Calculate i for $t = 2s$ and $t = 5s$.