Tutorial # 04

1. An a.c. voltage of peak value 20 V is connected in series with a silicon diode and load resistance of 500 Ω. If the forward resistance of the diode is 10 Ω, find : (i) peak current through diode (ii) peak output voltage across the load. What will be these values if the diode is assumed to be ideal ?

2. Find the current through the diode in the circuit shown in Fig. 1. Assume the diode to be ideal.

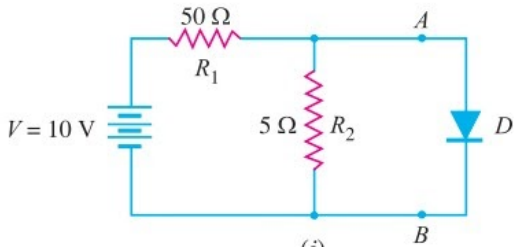

Fig. 1

3. Determine the current I in the circuit shown in Fig. 2. Assume the diodes to be of silicon (turn-On voltage = 0.7V) and forward resistance of diodes to be zero.

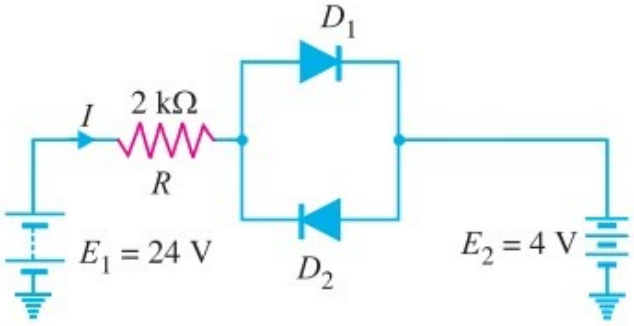

Fig. 2

4. A crystal diode having internal resistance r_f = 20 Ω is used for half-wave rectification. If the applied a.c. voltage is $v(t) = 50\ \mathrm{Sin}(\omega t)$ and load resistance R_L = 800 Ω, find: (*i*) I_m, I_{dc}, I_{rms} (*ii*) a.c. power input and d.c. power output (*iii*) d.c. output voltage (*iv*) efficiency of rectification.

5. A half-wave rectifier is used to supply 50V d.c. to a resistive load of 800 Ω. The diode has a resistance of 25 Ω. Calculate a.c. voltage required.

6. Consider a half-wave rectifier designed connecting a diode and a load resistance across the secondary winding of a step-down transformer. Let $v_s(t) = V_m \mathrm{Sin}\omega t$ be the alternating voltage that appears across the secondary winding. Let r_f and R_L be the diode resistance and load resistance, respectively. Show that the maximum rectifier efficiency $\eta_{max.} = 40.6\%$. What do you expect if you design a full wave rectifier?

7. A full-wave rectifier uses two diodes, the internal resistance of each diode may be assumed constant at 20 Ω. The transformer r.m.s. secondary voltage from centre tap to each end of secondary is 50 V and load resistance is 980 Ω. Find : (i) the average load current (ii) the r.m.s. value of load current.

8. For the circuit shown in Fig. 3, find the output d.c. voltage.

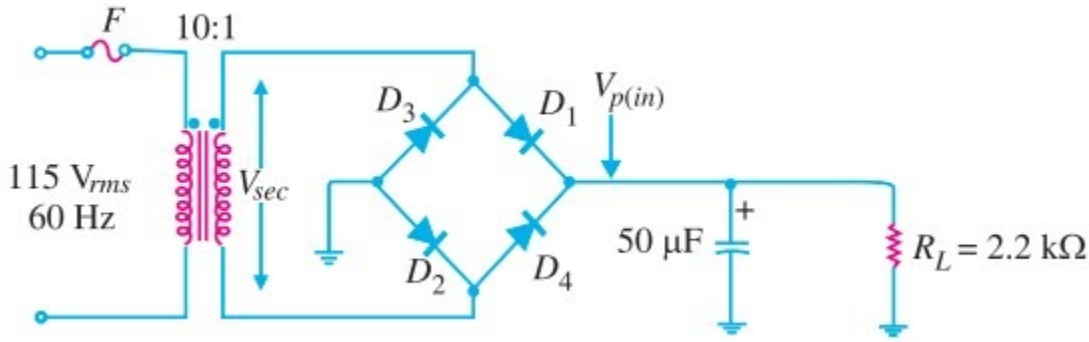

Fig. 3

9. The zener diode shown in Fig. 4 has V_Z = 18 V. The voltage across the load stays at 18 V as long as I_Z is maintained between 200 mA and 2 A. Find the value of series resistance R so that E_O remains 18 V while input voltage V_i is free to vary between 22 V to 28V.

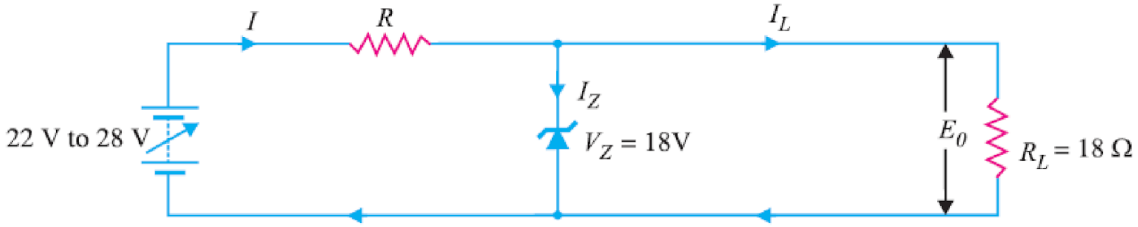

Fig. 4

10. A 10-V zener diode is used to regulate the voltage across a variable load resistor [see Fig. 5]. The input voltage varies between 13 V and 16 V and the load current varies between 10 mA and 85 mA. The minimum zener current is 15 mA. Calculate the value of series resistance R.

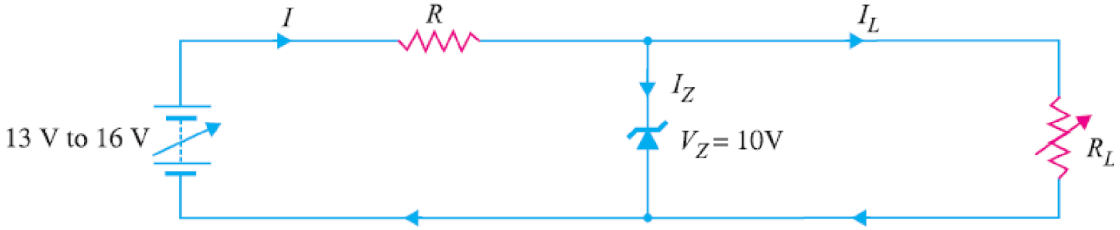

Fig. 5

11. The circuit of Fig. 6 uses two zener diodes, each rated at 15 V, 200 mA. If the circuit is connected to a 45-volt unregulated supply, determine :(*i*) The regulated output voltage (*ii*) The value of series resistance *R*.

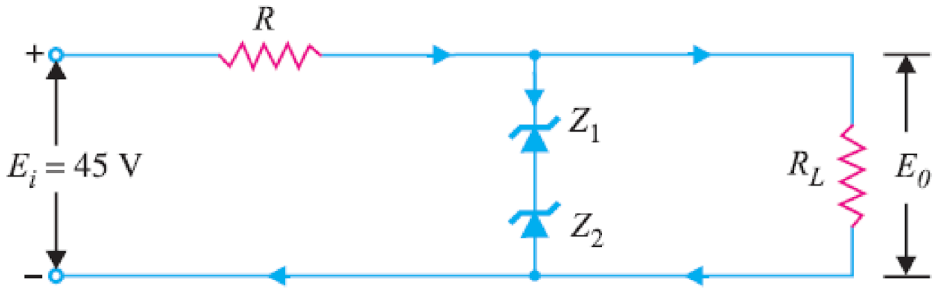

Fig. 6

12. What value of series resistance R is required when three 10-watt, 10-volt, 1000 mA zener diodes are connected in series to obtain a 30-volt regulated output from a 45 volt d.c. power source? [See Fig.7]

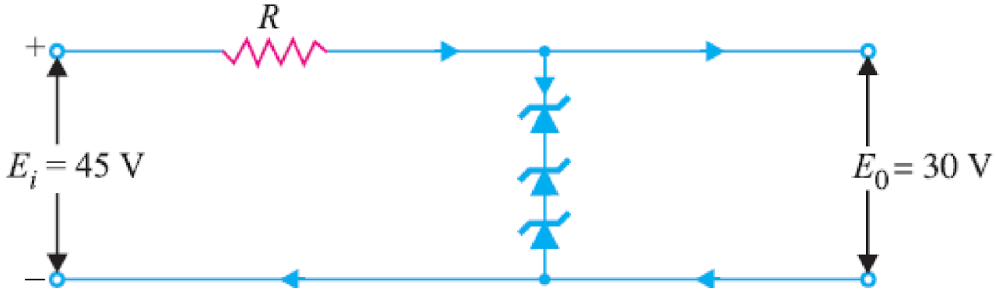

Fig. 7

13. Over what range of input voltage will the zener circuit shown in Fig. 8 maintain 30 V across 2000 Ω load, assuming that series resistance R = 200 Ω and zener current rating is 25 mA?

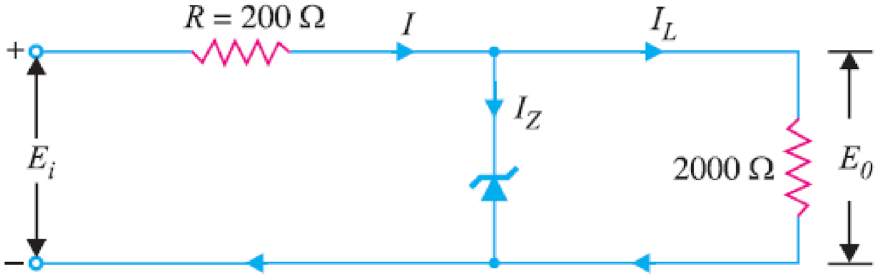

Fig. 8

14. In the circuit shown in Fig. 9, the voltage across the load is to be maintained at 12 V as load current varies from 0 to 200 mA. Design the regulator. Also find the maximum wattage rating of the zener diode.

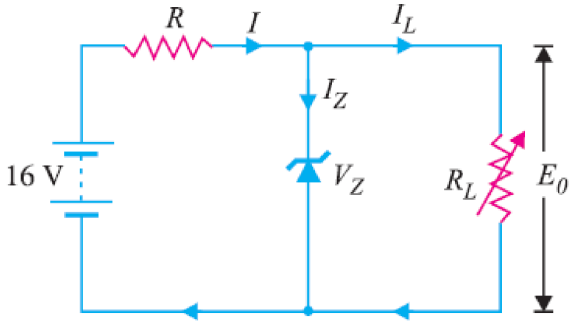

Fig. 9

15. In the circuit shown in Fig. 10, determine the range of R_L that will result in a constant voltage of 10 V across R_L.

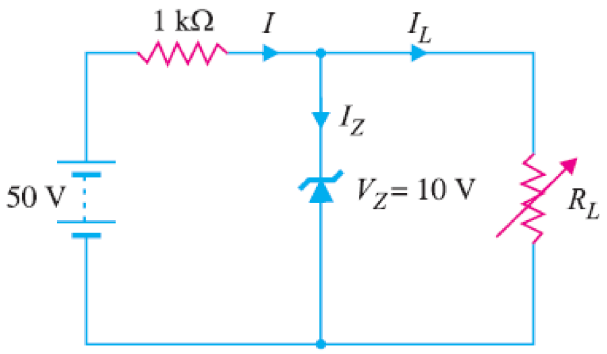

Fig. 10