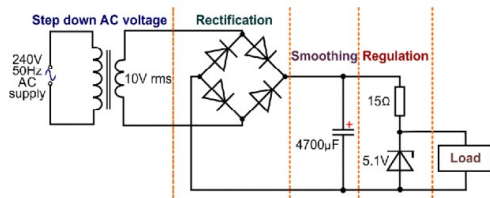


Further Mains Power Supplies*

Revision sheet

1 Recap from AS

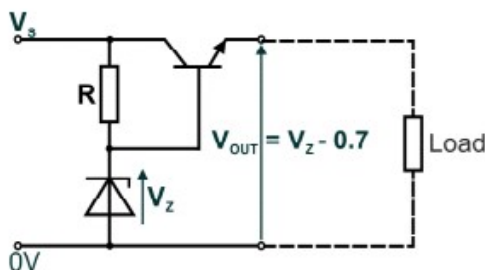


There are a few issues with this design, specifically the regulation subsystem:

- The Zener diode can't sustain output current & voltage when a drop in line voltage occurs
- Lots of power has to be dissipated in the resistor and zener diode.

2 Improvements on regulation

The performance of a Zener voltage regulator can be improved by incorporating an emitter follower into the output circuit. This reduces the power rating of the zener diode and resistor.

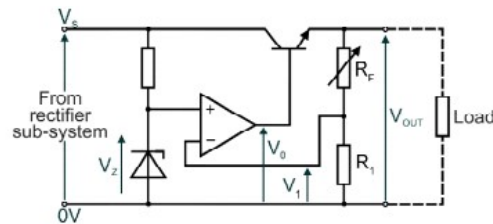


$$V_{out} = V_Z - 0.7$$

$$I_C = I_L$$

This design can be improved further by using an Op-amp.

3 Op-amp stabilised power supply



$$V_1 = V_{out} \times \frac{R_1}{R_f + R_1}$$

$$V_{out} = \left(1 + \frac{R_f}{R_1}\right)$$

Advantages of using this design:

- Op-amp keeps voltage very stable
- Op-amp supplies base current
- Op-amp draws no current

4 Load and Line regulation

Line regulation measures the ability of the power supply to maintain a steady output voltage when the input line voltage changes.

Load regulation measures the ability of the output voltage to remain constant when the output current changes due to a change in the load.

*Images from Wjec E-book