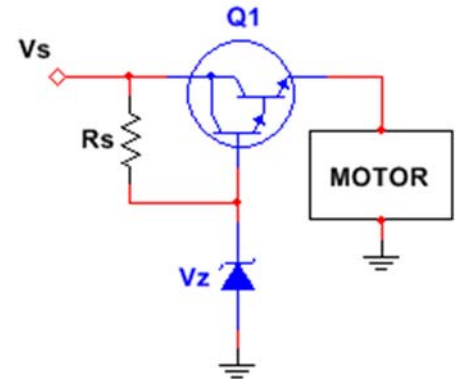


1 problem for 20 pts

Emitter Follower Design

1) You are asked to design a power supply for a 12V DC motor. The input voltage V_S comes from a supply that can vary from 15V to 17V. Here are the design constraints:

- Output voltage: must be within +/- 5% of 12V.
- The motor has a “no-load” current of 100 mA and a “stall” current of 2A. Design the power supply to provide up to 50% of the stall current.
- The zener must either be 11, 13, or 15V
- The Darlington transistor can either be a KSP13 or TIP120
- Available heat sinks are $\theta_{SA} = 6, 12, 18, \text{ and } 24 \text{ } ^\circ\text{C/W}$ (assume $T_A = 25 \text{ } ^\circ\text{C}$ and $\theta_{CS} = 0.5 \text{ } ^\circ\text{C/W}$).
- Use standard 5% resistor values.



- (a) Using “quick” analysis assumptions, determine the appropriate zener diode voltage. Show all work!
- (b) Perform a “quick” analysis to determine the appropriate transistor. If you need a heat sink, you must choose one of the available θ_{SA} . **You MUST explain why you chose one transistor and not the other one.**
- (c) Using “**typical**” parameters for your choice of transistor from part (b), determine the appropriate resistor R_S (choose standard 5% value).
- (d) Determine the proper power ratings for the zener and resistor. Choose from $\frac{1}{4}$, $\frac{1}{2}$, 1, or 2 W rating.

(extra sheet for work)