Indian Institute of Space Science and Technology
Department of Avionics
AV 211 Analog Electronic Circuits
Assignment 6 - Power Amplifiers, Differential Circuits

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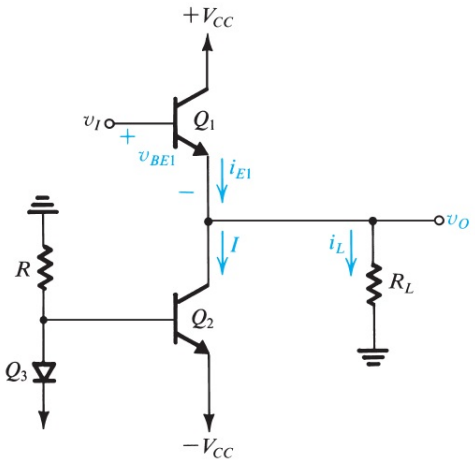
**Solve all the questions found below. In the case of design questions, you may make suitable design decisions.**

**Power Amplifiers**

1. Consider the Class-B push-pull power amplifier, where the finite $V_{BE}$ and $V_{CEsat}$ can be neglected. For a supply voltage of $\pm 10V$, what is the maximum power delivered to a $8\Omega$ load resistance? What is the corresponding supply power? Calculate the efficiency. If the output signal is half of this amplitude, what is the output power, supply power and corresponding efficiency?

2. A Class-B output stage is required to deliver an average power of 50 W into an $8\Omega$ load. The power supply should be 4V greater than the corresponding peak sine-wave output voltage. Determine the power supply voltages required (to the nearest volt in the appropriate direction) and the peak current from each supply, the total supply power and the power conversion efficiency. To this design, add suitable elements to provide short circuit protection and thermal stability and provide the component values.

3. A Class-A power amplifier (Emitter follower) shown in the figure below is designed such that $R_L = V_{CC}/I$. If the output is a sinusoid swinging between $\pm\frac{1}{2}V_{CC}$, what is the output power, supply power and efficiency. Also derive the power dissipation in each transistor.




**Differential Circuits**

4. Consider two signals $v_1(t) = 1.2 + 0.5\sin(2\pi 50t) + 0.005\sin(2\pi 2500t)$ and $v_1(t) = 1.2 + 0.5\sin(2\pi 50t) - 0.005\sin(2\pi 2500t)$. Write down the differential signal components and the common mode signal components.

5. Consider a npn-differential amplifier with a current source of 0.4 mA. $V_{CC}$ = 2.5V and $V_{EE}$ = -2.5V. $R_C = 5K\Omega$. Calculate the differential gain. If the current source has an output impedance of $30K\Omega$, what is the common mode gain and CMRR?