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**DEPARTMENT OF ELECTRONICS ENGINEERING**  
**ELECTRONIC CIRCUITS**  
**Power Amplifier Circuits**

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**Numerical 1:**

In a class AB push-pull power amplifier, load  $R_L$  is  $7\Omega$ , supply voltage  $V_{CC} = 22V$ ,  $V_{EE} = -22V$ . AC input voltage is 20V peak with frequency of 1000Hz. Calculate the efficiency of the circuit.

**Solution:** Assuming a diode biased class AB push-pull power amplifier as shown in figure 1:

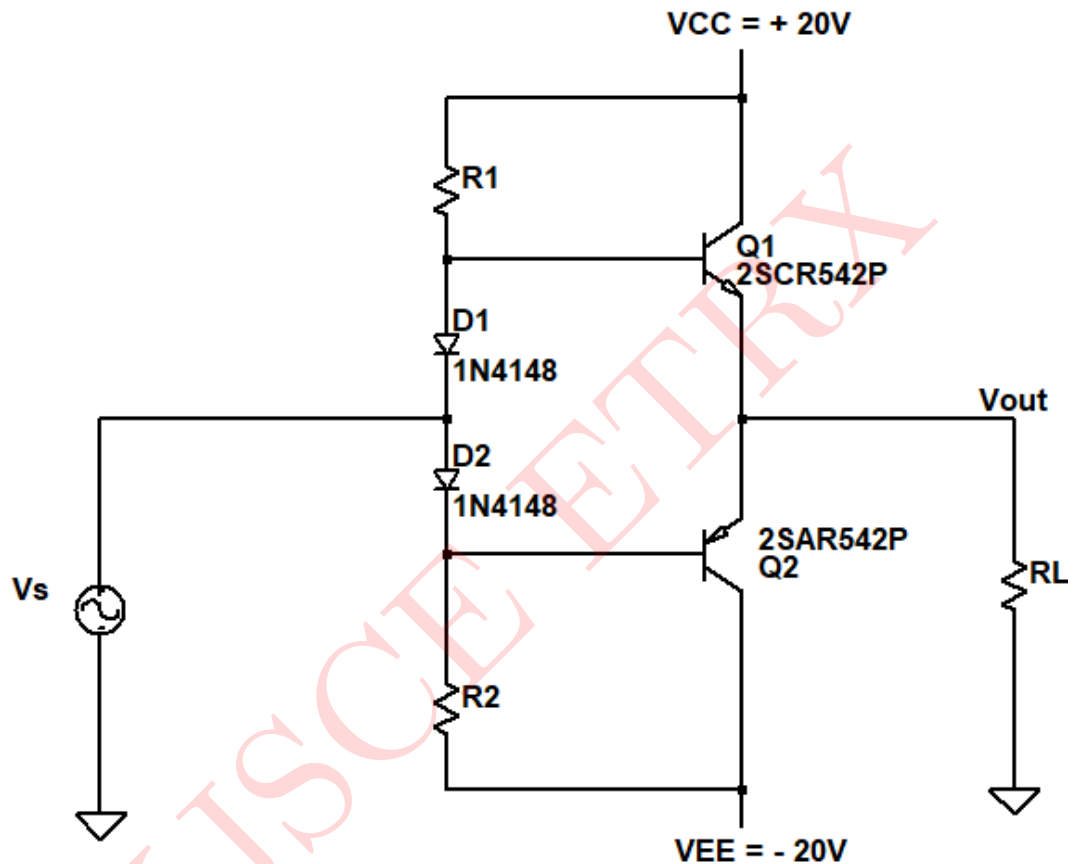


Figure 1: Circuit diagram

Q1 and Q2 are power transistors with  $I_C = 5A$  and  $V_{CEO} = 20V$   
 $R_1$  and  $R_2$  are used to improve efficiency of the power amplifier.

Circuit in figure 1 can be shown as:

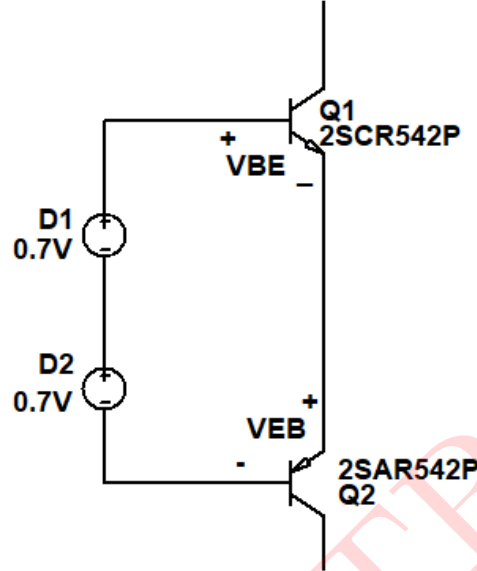


Figure 2: Equivalent circuit diagram

$$\therefore V_i + 0.7 - V_{BE} - V_o = 0$$

$$\therefore V_o = V_i + 0.7 - V_{BE} \quad \dots(\text{when Q1 conducts})$$

$$\therefore V_o = V_i \quad \dots(\because V_{BE} = 0.7)$$

Similarly, when Q2 conducts,  $V_o = V_i$

$$\therefore P_{out(AC)} = \frac{V_m^2}{2R_L}$$

here,  $V_m = 20V$  and  $R_L = 7\Omega$

$$\therefore P_{out(AC)} = \frac{20^2}{2 \times 7} = 28.5714V$$

$$\text{Also, } I_m = \frac{V_m}{R_L} = \frac{20}{7} = 2.8517A$$

DC input power is given as:

$$P_{in(DC)} = \frac{2V_{CC}I_m}{V_\pi} = \frac{2 \times 22 \times 2.8571}{\pi}$$

$$\therefore P_{in(DC)} = 40.0155$$

$$\% \text{ Efficiency } (\eta) = \frac{P_{out(AC)}}{P_{in(DC)}} \times 100 = \frac{28.5714}{40.0155} \times 100$$

$$\therefore \% \text{ Efficiency} = 71.4\%$$

### SIMULATED RESULTS:

Above circuit was simulated in LTspice and results obtained are as follows:

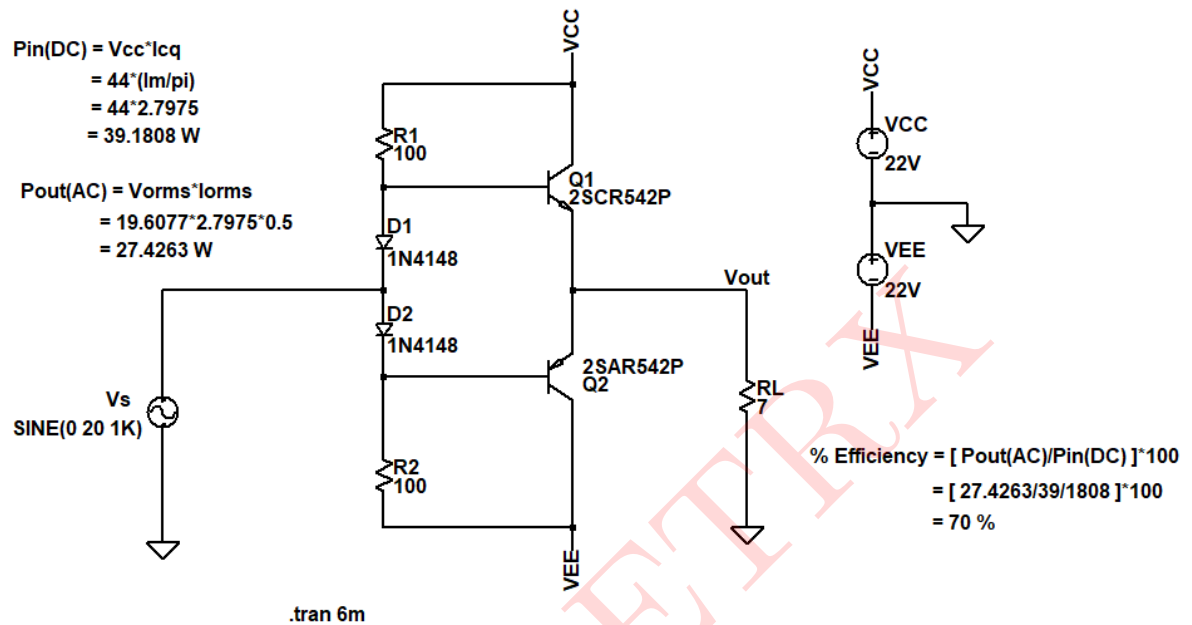


Figure 3: Circuit Schematic: Results

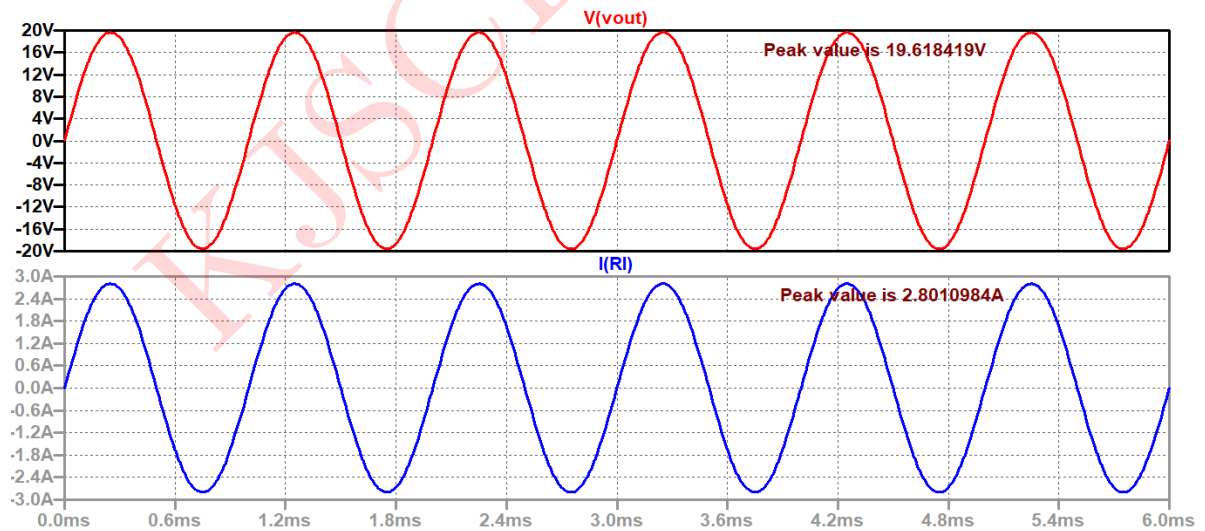


Figure 4: Output load voltage and load current waveform

**Comparison between theoretical and simulated values:**

Parameter	Theoretical value	Simulated value
Input DC power	40.0155W	39.1808W
Output AC power	28.5714W	27.4263W
Efficiency	71.4%	70%

Table 1: Numerical 1

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