

**K. J. SOMAIYA COLLEGE OF ENGINEERING**  
**DEPARTMENT OF ELECTRONICS ENGINEERING**  
**ELECTRONIC CIRCUITS**  
**Power Amplifier Circuits**

16<sup>th</sup> July, 2020

Numericals

**Numerical 1:** In a class B power amplifier, load  $R_L = 12\Omega$ , supply voltages is  $V_{CC} = 15V$ ,  $V_{EE} = -15V$ , AC input voltage 14V peak, frequency is 1000Hz. Calculate efficiency of circuit.

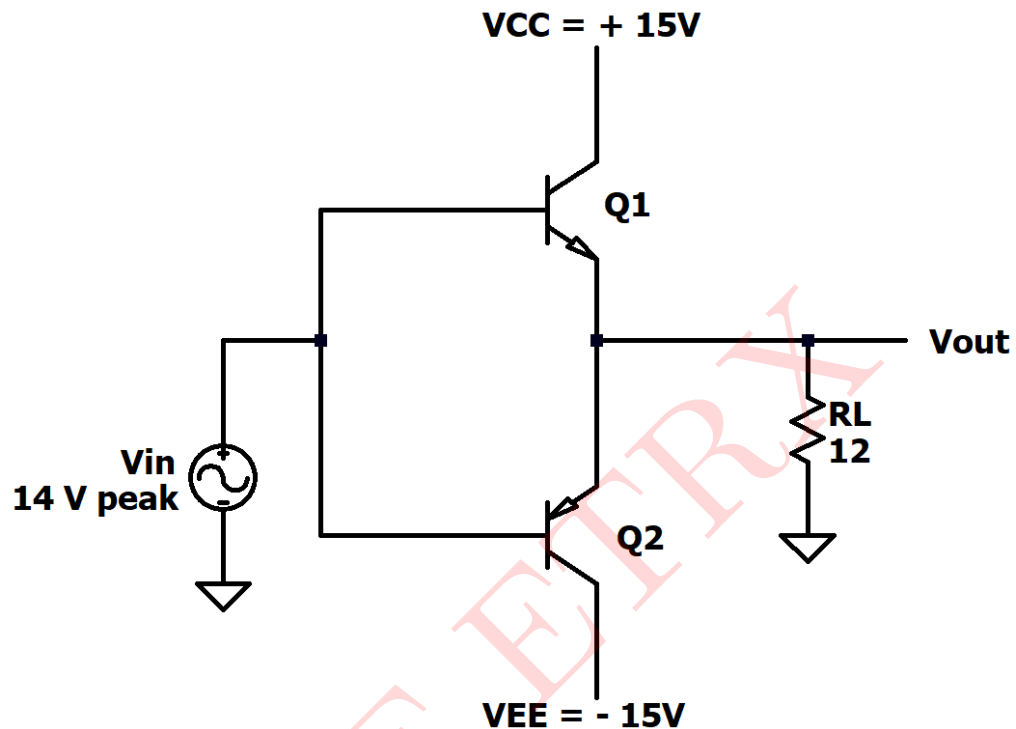


Figure 1: Circuit 1

**Solution:**

$$V_{in} = V_m \sin \omega t = V_m \sin(2\pi f t) = 14 \sin(2\pi \times 1000 t)$$

$$V_m = 14V$$

**AC power at the load ( $P_{ac}$ ):**

$$P_{ac} = \frac{V_m^2}{2R_L} = \frac{14^2}{2 \times 12} = 8.16W$$

**DC power input to the amplifier ( $P_{dc}$ ):**

$$P_{dc} = \frac{2V_{CC}I_m}{\pi}$$

$$\text{Here } I_m = \frac{V_m}{R_L} = \frac{14}{12} = 1.1667A$$

$$\therefore P_{dc} = \frac{2 \times 15 \times 1.1667}{\pi} = 11.141W$$

**Efficiency:**

$$\eta = \frac{P_{ac}}{P_{dc}} \times 100 = \frac{8.16}{11.145} \times 100 = 73.2$$

$$\% \text{ Efficiency} = 73.2\%$$

### SIMULATED RESULTS:

Above circuit is simulated in LTspice and the result is as follows:

**Q1 and Q2 are Power Transistors with  $I_c = 5A$  and  $V_{CEO} = 30V$**

$$\begin{aligned} P_{in} (DC) &= V_{CC} \times I_{CQ} \\ &= 30 \times (I_m / \pi) \\ &= 30 \times (1.10297 / \pi) \end{aligned}$$

$$P_{in} (DC) = 10.5325 \text{ W}$$

$$\begin{aligned} P_{out} (AC) &= V_{rms} \times I_{rms} \\ &= V_{om} \times I_{om} \times 0.5 \\ &= 1.10297 \times 13.23548 \times 0.5 \end{aligned}$$

$$P_{out} (AC) = 7.299 \text{ W}$$

$$\begin{aligned} \% \text{ Efficiency} &= 100 \times [P_{out} (AC) / P_{in} (DC)] \\ &= 100 \times [7.299 / 10.5325] \end{aligned}$$

$$\% \text{ Efficiency} = 69.3 \%$$

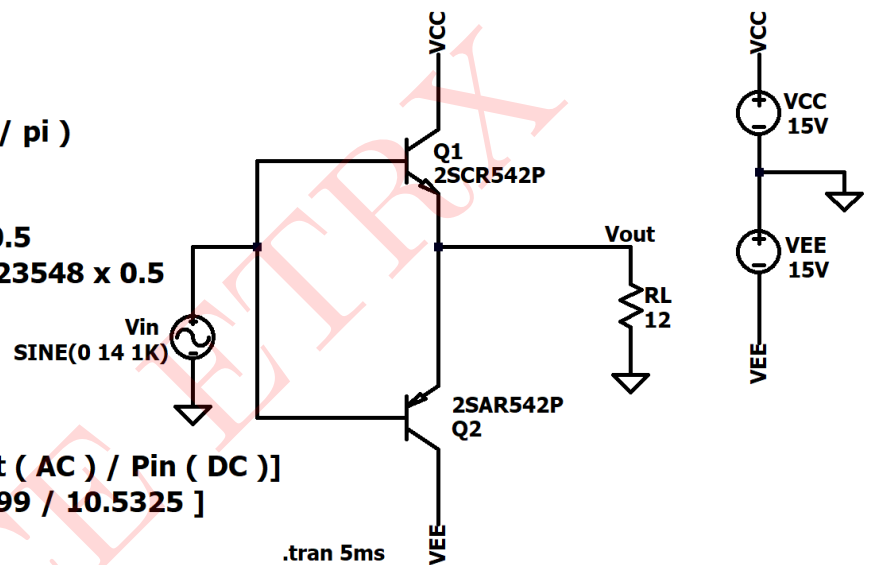


Figure 2: Circuit Schematic

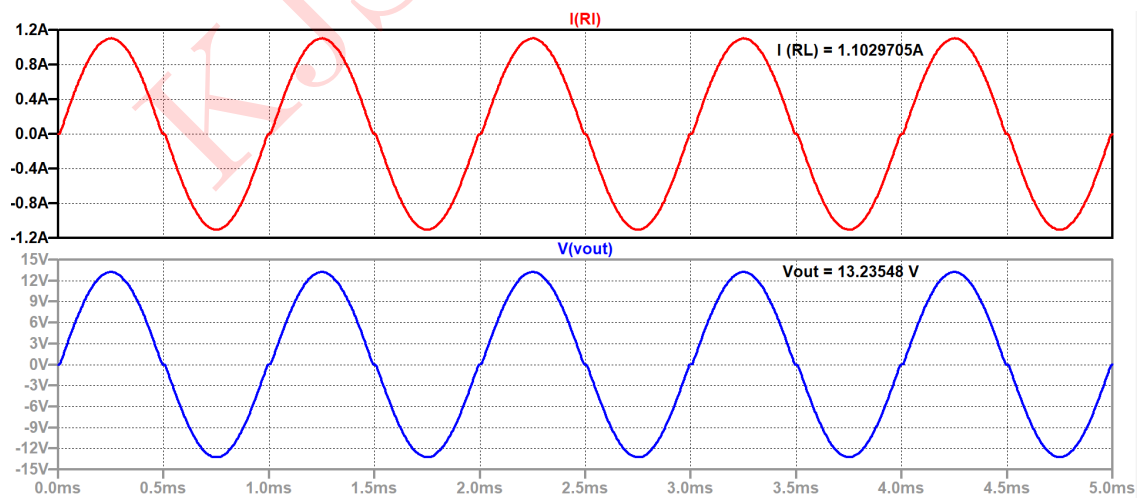


Figure 3: Output load voltage and current waveform

**Comparison between Theoretical and Simulated values :-**

Parameters	Simulated	Theoretical
Input DC power	10.5325W	11.141W
Output AC power	7.299W	8.16W
% Efficiency	69.3%	73.2%

Table 1: Numerical 1

\*\*\*\*\*

KJSCE ETRX