SOLUTIONS OF TUT. SHEET NO. 7

Q1 & Q2: SOLUTION

Q1 $A_{mid} = 10$, $f_L = 20Hz$ and $f_H = 20KHz$

$$\frac{(A_{mid})^n}{1+\frac{f_L}{}}$$

$$A_v(f = 7.5Hz) = \frac{(10)^n}{\left[1+\left(20/7.5\right)^2\right]^{n/2}}$$

$$= 152$$

$$A_v(f = 200KHz) = \frac{(10)^n}{\left[1+\left(200K/20K\right)^2\right]^{n/2}}$$

$$= 0.98$$

Q2.

$f_L = 20Hz$, $f_H = 20KHz$

(i) $$f_L^* = \frac{f_L}{\sqrt{2^{1/n}-1}}$$

$$\therefore f_L = f_L^*\sqrt{2^{1/n}-1} = 20\times\sqrt{2^{1/3}-1}$$

$$= 10.196\,Hz$$

(ii) $$f_H^* = f_H\sqrt{2^{1/n}-1}$$

$$\therefore f_H = \frac{f_H^*}{\sqrt{2^{1/n}-1}} = \frac{20\times10^3}{\sqrt{2^{1/n}-1}} = \frac{20\times10^3}{\sqrt{2^{1/3}-1}}$$

$$= 39.23\,KHz$$

(iii) Bandwidth $f_H - f_L = 39.23\times10^3 - 10.196$

$$= 39.218\,KHz$$

Q3: SOLUTION

Solution: We know that the overall voltage gain in dB of the three-stage amplifier is given as

$$A_{dB} = A_{dB1} + A_{dB2} + A_{dB3}$$

But, we are given the voltage gains of the individual stages as ratios. So, we should first find the gains of the individual stages in decibels. Thus

$$A_{dB1} = 20 \log_{10} 30 = 29.54 \text{ dB}$$

$$A_{dB2} = 20 \log_{10} 50 = 33.98 \text{ dB}$$

$$A_{dB3} = 20 \log_{10} 80 = 38.06 \text{ dB}$$

Therefore

$$A_{dB} = 29.54 + 33.98 + 38.06 = \mathbf{101.58 \text{ dB}}$$

Alternatively, we could have determined A_{dB} as follows: The overall voltage gain is

$$A = A_1 \times A_2 \times A_3$$

$$= 30 \times 50 \times 80 = 120\,000$$

Therefore, the overall voltage gain in dB is

$$A_{dB} = 20 \log_{10} 120\,000 = \mathbf{101.58 \text{ dB}}$$

Q4: SOLUTION

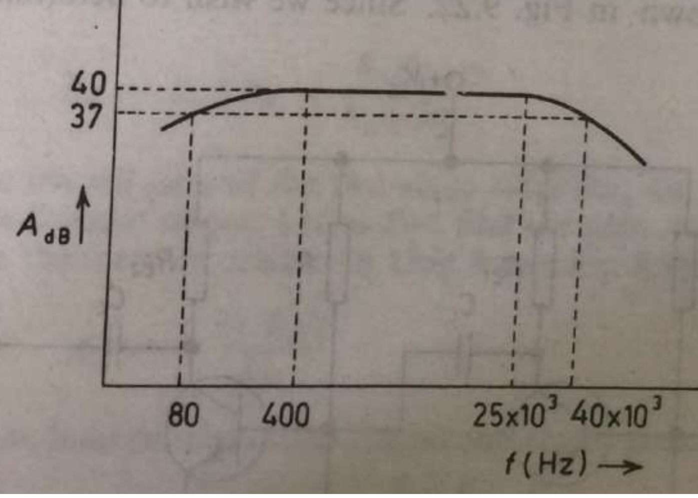
Solution: The gain in dB is

$$A_{dB} = 20 \log_{10} A = 20 \log_{10} 100 = 40 \text{ dB}$$

This is the mid-band gain. The gain at cut-off frequencies is 3 dB less than the mid-band gain, i.e.

$$(A_{dB}) \text{ (at cut-off frequencies)} = 40 - 3 = 37 \text{ dB}$$

The plot of the frequency response curve is given in Fig. 9.20.



Q5: SOLUTION

Solution a. From Eq. (12-33) we have

$$f_L = \frac{1}{2\pi(R_o' + R_i')C_b} \leq 10$$

or

$$C_b \geq \frac{1}{62.8(R_o' + R_i')}$$

Since $R_i' = 1$ M and $R_o' < R_y = 1$ K, then $R_o' + R_i' \approx 1$ M and $C_b \geq 0.016$ μF.

b. From Eq. (8-35) we find for a transistor $R_o \geq 1/h_{oe} \approx 40$ K, and hence $R_o' \approx R_c = 1$ K. If we assume that $R_b \gg R_i = 1$ K, then $R_i' \approx 1$ K. Hence

$$C_b \geq \frac{1}{(62.8)(2 \times 10^3)} \text{ F} = 8.0\ \mu\text{F}$$