“In the name of God”

Tutorial of ECE 340 Course

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5.1 The amplifier shown in Figure 1 has $R_{sig} = R_L = R_C = 1k\Omega,\ \ R_B = 47k\Omega,\ \ \beta = 100,\ \ C_\mu = 0.8\,pF\,, and\ f_T = 600\,MHz$. Assume the coupling capacitors to be very large.

(a) Find the dc collector current of the transistor.

(b) Find g_m and r_π.

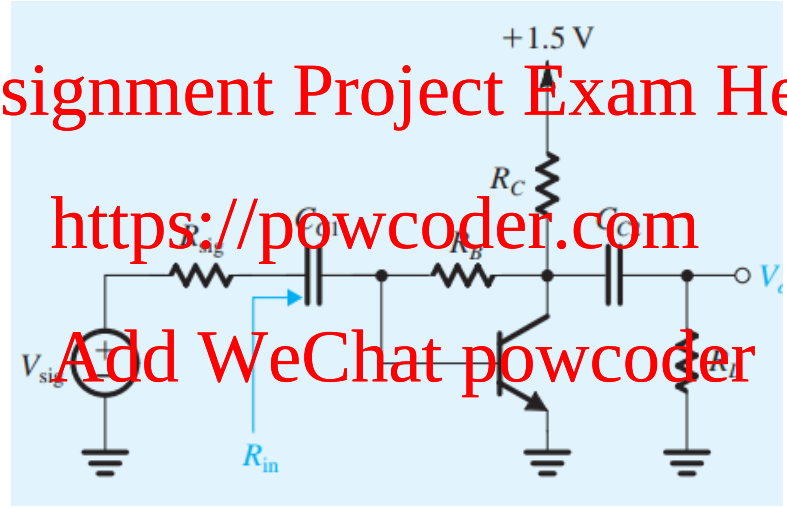
(c) Neglecting r_o, find the midband voltage gain from base to collector

(d) Use the gain obtained in (c) to find the component of R_{in} that arises as a result of R_B. Hence find R_{in}.

(e) Find the overall gain at midband.

(f) Find C_{in}.

(g) Find f_H.



5.2 First consider the CS amplifier of Figure 2(a) show that $A_M = -g_m r_o\,,\ \tau_H = C_{gs}R_{sig} + C_{gd}\left[R_{sig}(1 + g_m r_o) + r_o\right] + C_L r_o$

Where C_L is the total capacitance between the output node and ground. Calculate the value of A_M, f_H and the gain-bandwidth product for the case $g_m = 1\frac{mA}{V}, r_o = 20\ k\Omega, R_{sig} = 20\ k\Omega, C_{gs} = 20\ fF$, $C_{gd} = 5fF$, and $C_L = 10\ fF$.

(b) For the CD-CS amplifier in Figure 2(b), show that $A_M = -\frac{r_{o1}}{\frac{1}{g_{m1}} + r_{o1}}(g_{m2}r_{o2})$

$$\tau_H = C_{gd1}R_{sig} + C_{gs1}\frac{R_{sig}+r_{o1}}{1+g_{m1}r_{o1}} + C_{gs2}\left(\frac{1}{g_{m1}}||r_{o1}\right) + C_{gd2}\left[\left(\frac{1}{g_{m1}}\middle||r_{o1}\right)(1+g_{m2}r_{o2}) + r_{o2}\right] + C_L r_{o2}$$

Calculate the values of A_M, f_H, and the gain-bandwidth product for the same parameter values used in (a).