ECE 322 Electronics-1, Fall 2019

Test Date: 11/20/2019

Problems: 3

Total Pages: 8

Name: _____

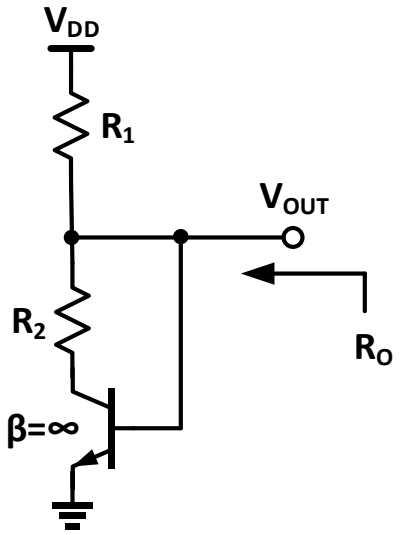
1. **(20 points) _____**
2. **(20 points + 5 Bonus) _____**
3. **(20 points) _____**

Total (60 points) _____

Good Luck!

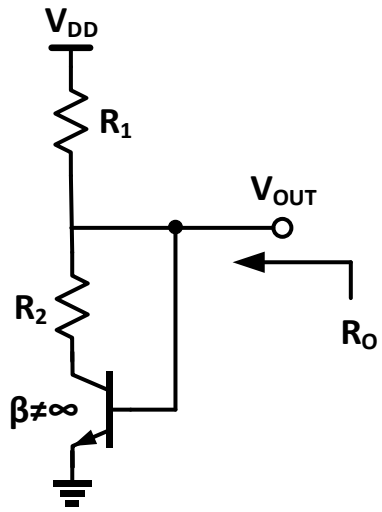
Problem 1 (a) (10 points): For circuit shown below, draw the small signal model and derive the small signal resistance R_O. The current gain **β is infinite**. Assume transconductance of the BJT = gm.

R_O = _____



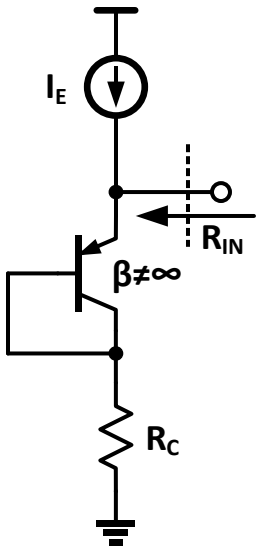
(b) (10 points): For circuit shown below, draw the small signal model and derive the small signal resistance R_O. The current gain **β is finite**. Assume transconductance of the BJT = gm.

R_O = _____



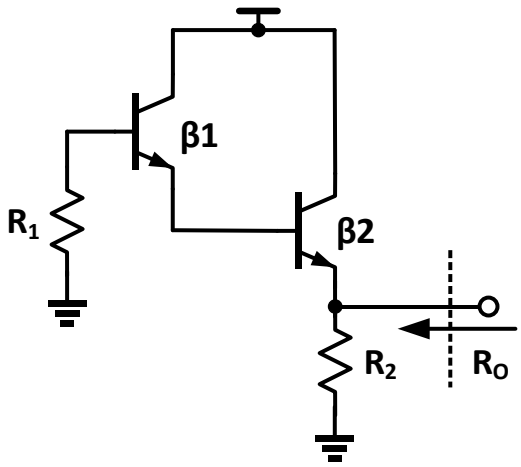
Problem 2(a): (10 points) For circuit shown below, draw the small signal model and derive the small signal resistance R_{IN}. The current gain **β is finite**. Assume transconductance of the BJT = gm.

R_{IN} = _____



(b): (10 points) For circuit shown below, draw the small signal "Hybrid pi" model and derive the small signal resistance R_O. You can assume transconductances of the BJTs as gm1 and gm2 and base resistances as $r\pi 1$ and $r\pi 2$.

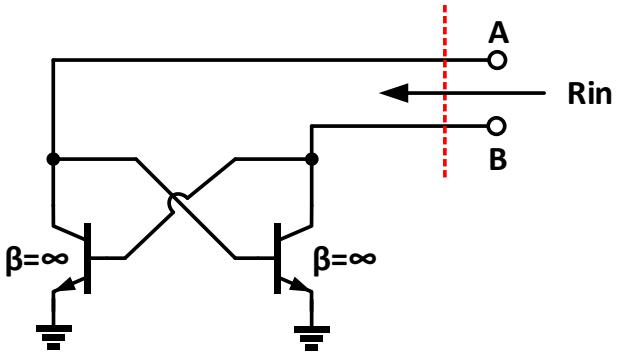
R_O = _____



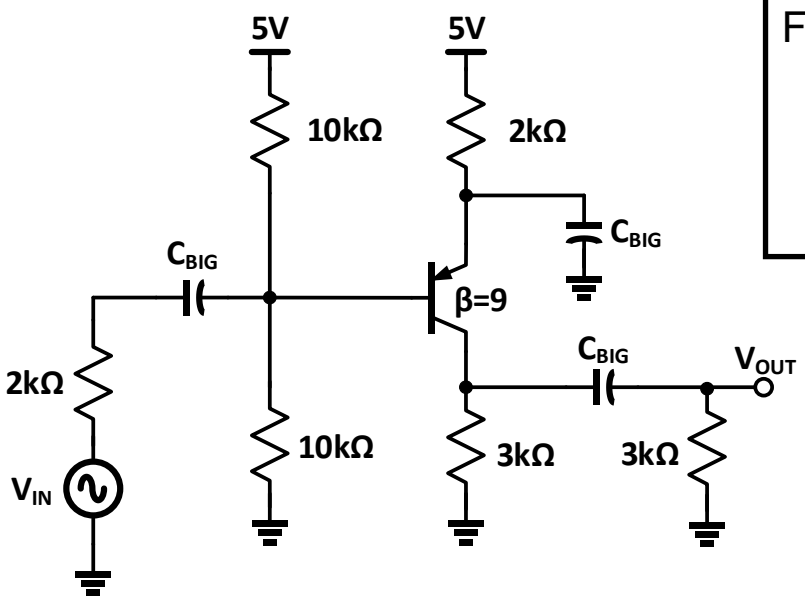
Bonus (5 points) For circuit shown below, the two BJTs are similar. Assuming transconductance **gm** for both the BJTs, draw the small signal "Hybrid pi" model and derive the small signal resistance R_{IN} looking between port A and port B.

(Note: No partial credit in Bonus Problem)

R_{IN} = _____



Problem 3: (20 points) For the amplifier circuit shown below, calculate the amplifier gain V_{OUT}/V_{IN} through small signal analysis (show the complete analysis). Assume $|V_{BE}|=0.7V$



Final Answer