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University of North Carolina at Charlotte
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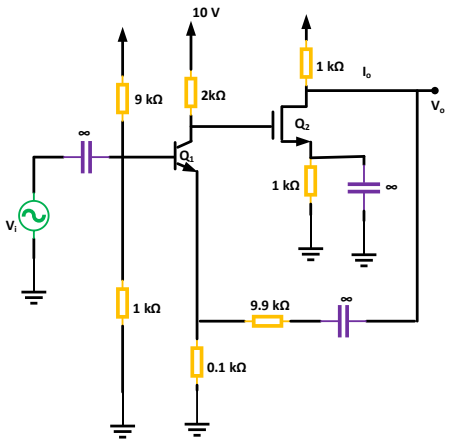
Fall 2023

ECGR 3132: Electronics **Breadth Exam** **Date: 11/03/2023**

Name:----------



Q: The circuit given in Figure 1 has the following parameters:

$K_n = 0.25\frac{mA}{V^2},\ V_T = 1\,V\,;\beta = 100, V_{BE} = 0.7\,V.$

Use: $I_D = K_n(V_{GS} - V_T)^2,$ and

$g_m(MOS) = 2K_n(V_{GS} - V_T).$

Ignore base current.

Figure 1:

(i)	Calculate: Q_1: (V_{CEQ}, I_{CQ})	(***10 Points***)
(ii)	Calculate: Q_2: (V_{DSQ}, I_{DSQ})	(***10 Points***)
(iii)	Identify the topology	(**5 points**)
(iv)	Identify the B-Circuit to calculate $A_{vf} = \frac{v_o}{v_i}$.	(***5 Points***)
(v)	Using the topology method find R_1, R_2 and B.	(***15 Points***)
(vi)	Draw the small-signal equivalent circuit and find $A_{vf} = \frac{v_o}{v_i}$.	(***30 Points***)
(vii)	Find $A_{vf} = \frac{v_o}{v_i}$ using the T-method.	(***20 Points***)
(viii)	Compare results of (v) and (vi), if different, why?	(***5 Points***)