109CC04

國立臺北科技大學 109 學年度碩士班招生考試

系所組別：2240 電子工程系碩士班丁組

第一節　電子學　試題

注意事項：

1. 本試題共三題，共 100 分。
2. 不必抄題，作答時請將試題題號及答案依照順序寫在答案卷上。
3. 全部答案均須在答案卷之答案欄內作答，否則不予計分。

一、(30%) Consider a cascaded amplifier in Fig. 1. The R_S=10 kΩ, R_{i1}=90 kΩ, R_{o1}=5 kΩ, R_{i2}=95 kΩ, R_{o2}=20 kΩ, and R_L=80 kΩ.

1. Calculate voltage gain of the stage 1 ($A_{v1} \equiv v_{i2}/v_{i1}$). (10%)
2. Calculate the overall voltage gain (v_L/v_s). (10%)
3. Calculate the overall current gain (i_o/i_i). (10%)

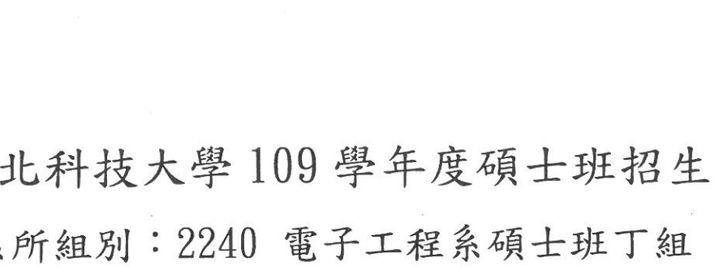

Fig. 1

二、(40%) Fig. 2 shows a BJT amplifier in forward active mode. Resistor r_o due to channel length modulation should be considered.

1. Please plot the overall equivalent small-signal circuit by using π model. (10%)
2. Please derive the overall voltage gain ($G_v \equiv v_o/v_s$). (10%)
3. Please derive the input resistance (R_{in}) and output resistance (R_{out}). (10%)
4. Please derive the shorted-circuit current gain (A_{is}) in terms of g_m, R_B, and r_π. (10%)

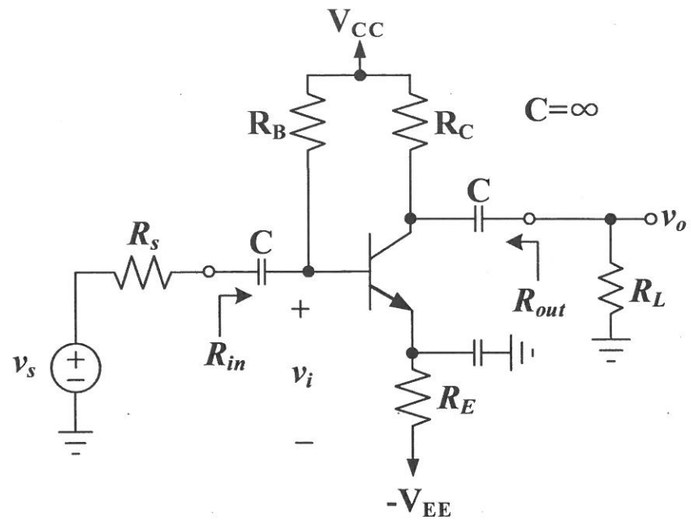

Fig. 2

三、(30%) Fig. 3 shows a high-frequency equivalent circuit of a MOS amplifier. Please use open-circuit time constants to characterize this circuit.

1. Derive the open-circuit time constant of C_{gs1}. (5%)
2. Derive the open-circuit time constant of C_{gd1}. (10%)
3. Derive upper 3-dB frequency ω_H. (5%)
4. Derive the midband gain ($A_M \equiv v_o/v_{in}$). (10%)

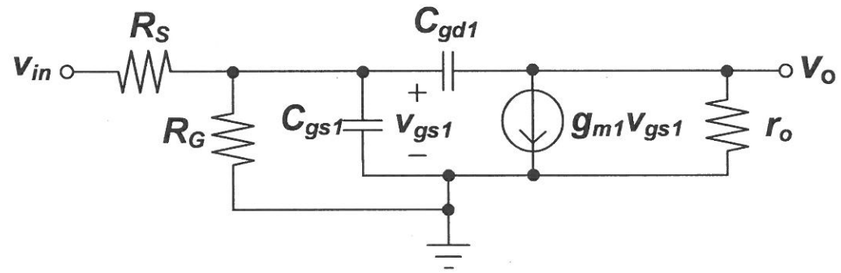

Fig. 3