國立中正大學 114 學年度碩士班招生考試試題

科目名稱：電子學　　本科目共 3 頁　第 1 頁

系所組別：機械工程學系光機電整合工程

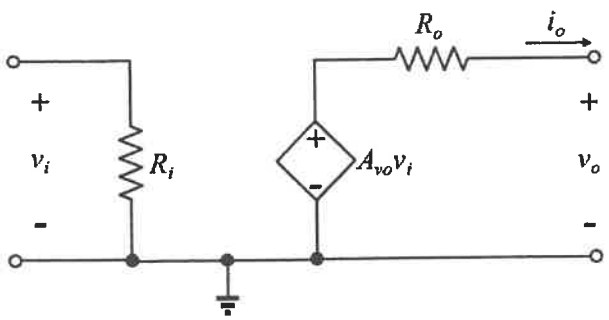
1. (10%) Consider an amplifier operating from ±10 V (voltage) power supplies. It is fed with a sinusoidal voltage having 1 V peak and delivers a sinusoidal voltage output of 9 V peak to a 1 kΩ (kilo ohm) load. The amplifier draws a current of 9.5 mA (milli ampere) from each of its two power supplies. The input current of the amplifier is found to be sinusoidal with 0.1 mA peak. Find the power drawn from the dc supplies, the power dissipated in the amplifier, and the amplifier power efficiency. ($\eta \equiv \frac{P_L}{P_{dc}} \times 100$)

2. (10%) List by table the ideal characteristics for input-output resistances R_i-R_o values for all four amplifier types: voltage, current, transconductance, and transresistance amplifiers. (0 or ∞)

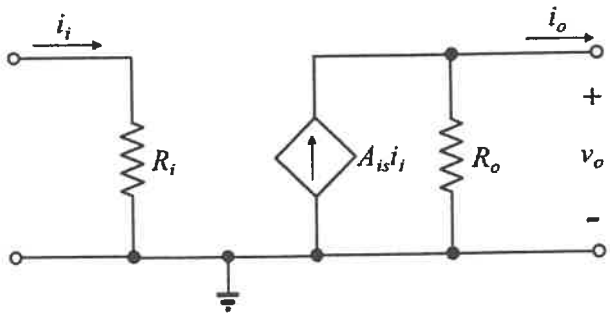
Ideal R	Voltage amplifiers	Current amplifiers	Transconductance amplifiers	Transresistance amplifiers
R_{in}				
R_o				

3. (15%) The four basic types of amplifiers (voltage, current, trans-conductance, and trans-resistance amplifiers). Please write the relationship that shows how the three gains A_{is} (Short-Circuit Current Gain)、R_m (Open-Circuit Transresistance)、G_m (Short-Circuit Transconductance) are converted into A_{vo} (Open-Circuit Voltage Gain). (5% for each)

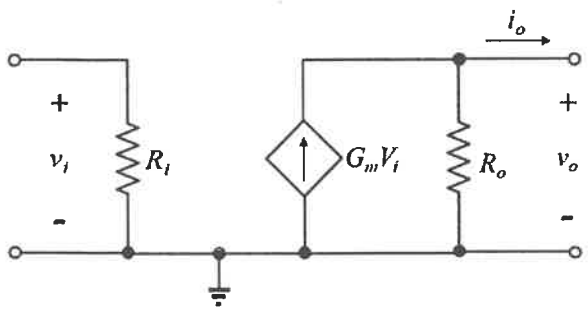
Voltage Amplifier



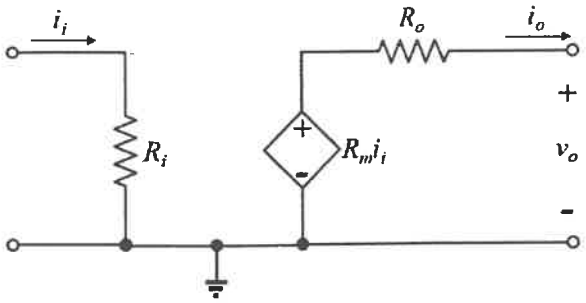
Current Amplifier



Transconductance Amplifier



Transresistance Amplifier

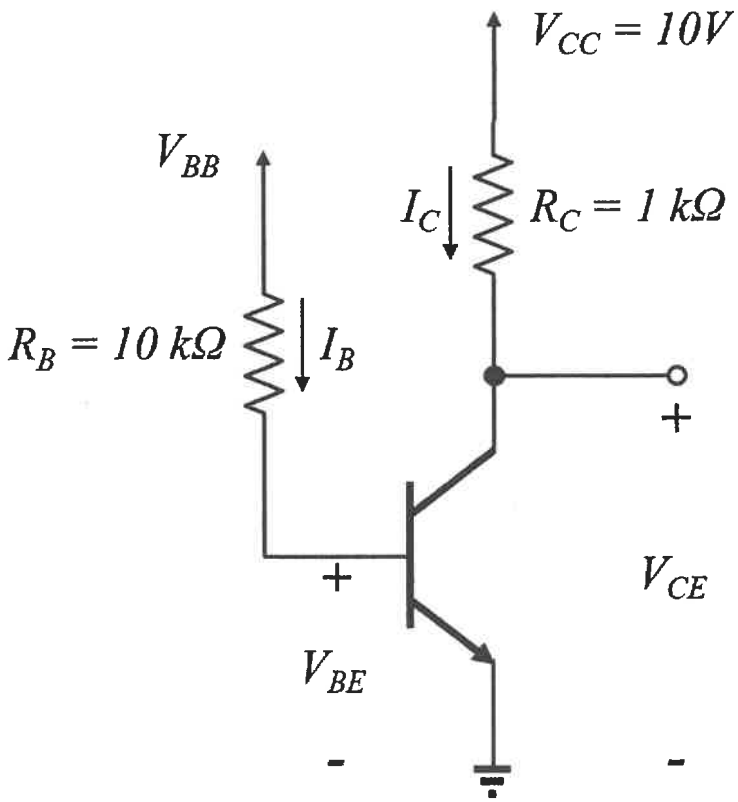


4. (15%) Assume that V_{BE} stays constant at 0.7 V (voltage) and the transistor $\beta = 50$, determine the value of V_{BB} required in the following cases:

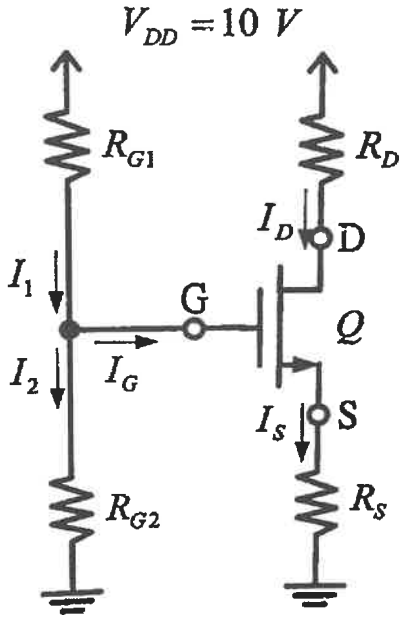
(a) In the active mode with V_{CE}=5 V (5%)

(b) At the edge of saturation clamping (5%)

(c) Deep saturation with the transistor β_{forced}=10 (5%)



5. (40%) For circuit below, where MOSFET is in saturation, **Threshold voltage** V_t = 1 V, **MOSFET transconductance parameter** k_n = 0.5 mA/V^2,
$R_{G1} = R_{G2}$ = 5 MΩ, $R_D = R_S$ = 6 kΩ.
Find gate voltage V_G (10%), source voltage V_S (10%), drain voltage V_D (10%) and drain current I_D. (10%)



6. (10%) For circuit below, where **Input voltage** V_{in} = 5 V, R_1 = 1 kΩ and R_2 = 5 kΩ.
Find output voltage V_{out}.