

# 國立臺北科技大學

## 九十六學年度電腦與通訊研究所碩士在職專班入學考試

### 丁組：電子學試題

填准考證號碼

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第一頁 共二頁

#### 注意事項：

1. 本試題共【六】題，配分共 100 分。
2. 請按順序標明題號作答，不必抄題。
3. 全部答案均須答在試卷答案欄內，否則不予計分。

1. For the circuit in Fig. 1, assume the diode turn-on voltage  $V_T = 0.7V$  and forward diode resistance  $r_f = 0$  for each diode,
  - (a) Please calculate the voltages  $V_A$  and  $V_B$ . (8%)
  - (b) Please calculate the current  $I_{D1}$ ,  $I_{D2}$  and  $I_{D3}$  in each diode. (12%)

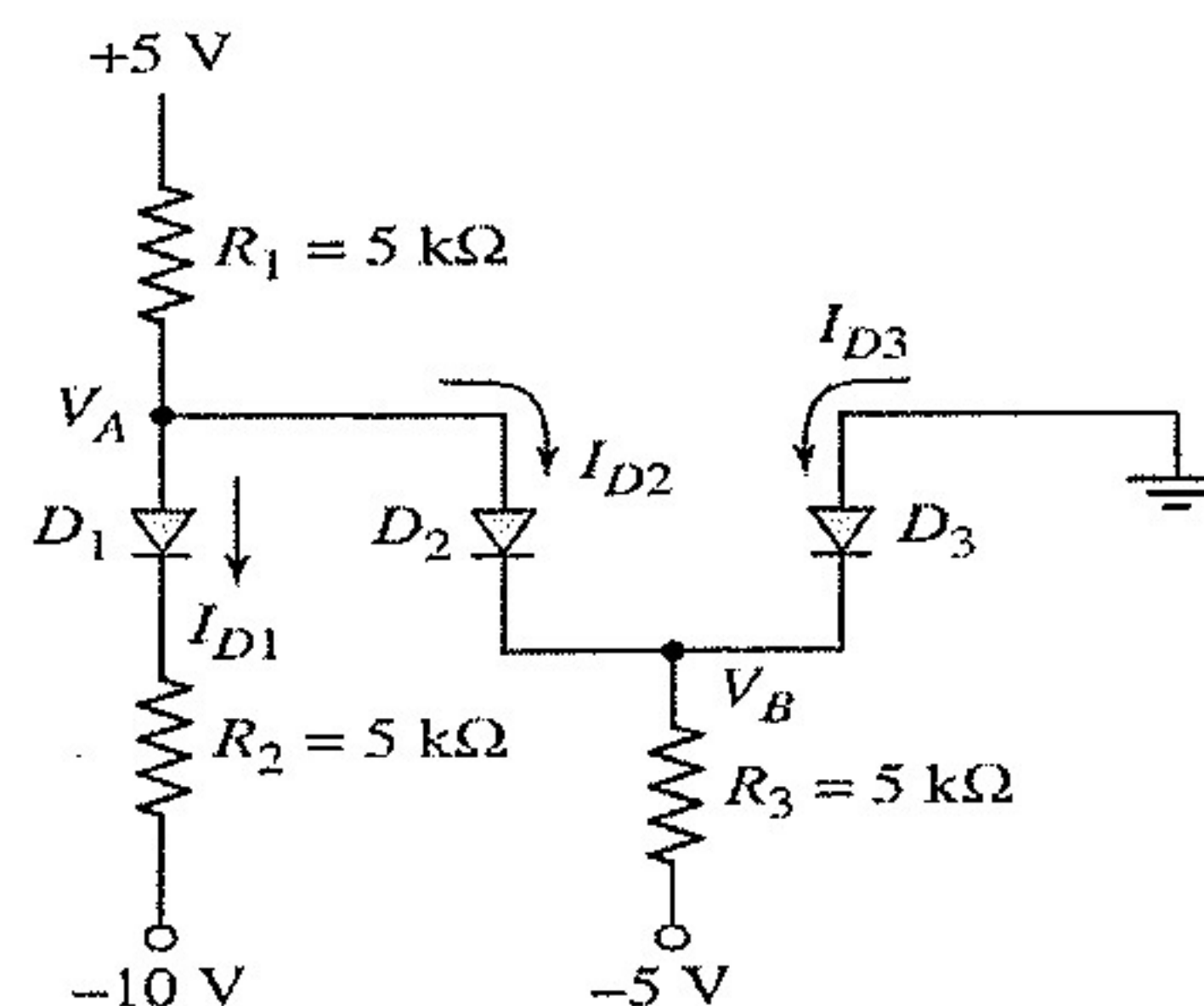


Fig.1 Diode circuit for problem 1

2. The  $N$ -bit D/A converter with an  $R$ - $2R$  ladder network in Fig. 2 is to be designed as a 6-bit D/A device. Let  $V_{REF} = -5.0V$  and  $R = R_F = 5.0k\Omega$ .
  - (a) What are the currents  $I_1$  and  $I_6$ ? (5%)
  - (b) The input changes by 1 least significant bit (LSB). What is the change in the output voltage? (5%)
  - (c) What is the output voltage if the input is 010011? (5%)
  - (d) What is the change in output voltage if the input changes from 101010 to 010101? (5%)

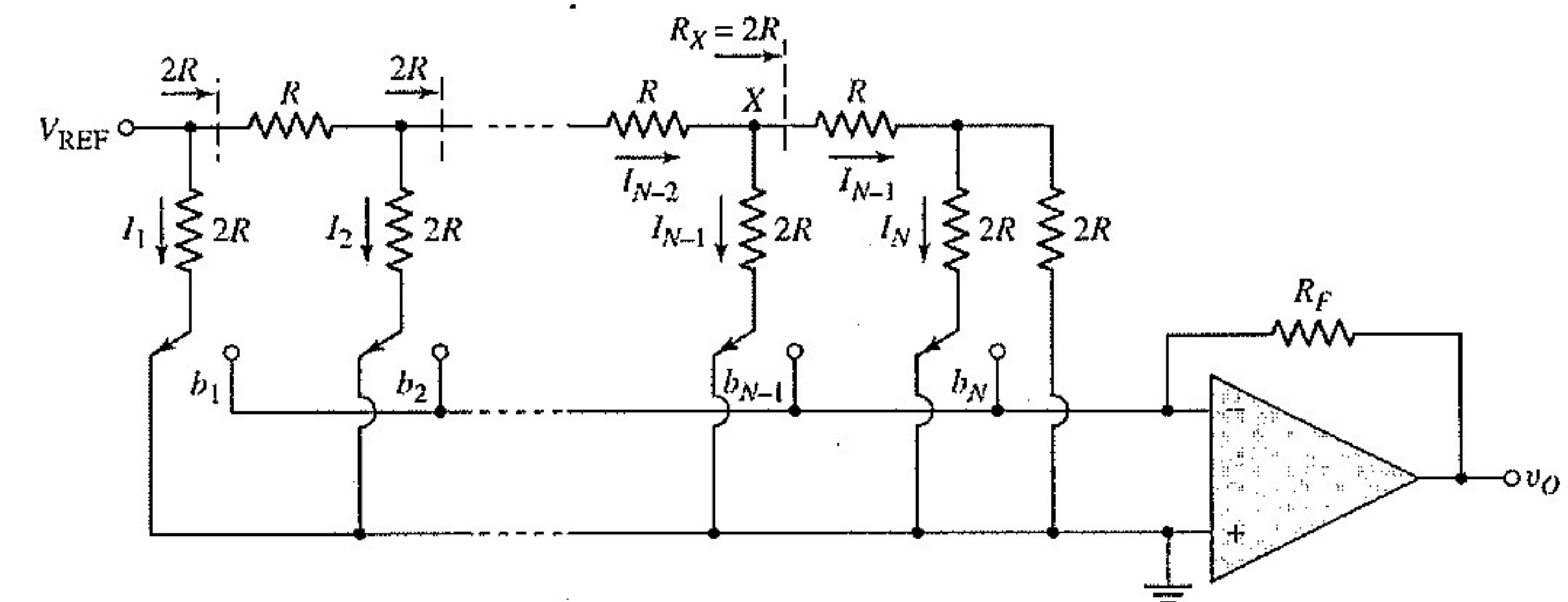


Fig.2 The  $N$ -bit D/A converter with an  $R$ - $2R$  ladder network circuit

3. For the circuit shown in Fig. 3, the parameters are:  $V_{BB} = 4V$ ,  $R_B = 220 k\Omega$ ,  $R_C = 2 k\Omega$ ,  $V_{CC} = 10V$ ,  $V_{BE(on)} = 0.7V$ , and  $\beta = 200$ .
  - (a) Calculate the  $I_B$ ,  $I_C$  and  $V_{CE}$ . (15%)
  - (b) Calculate the power dissipation ( $P_T$ ) in the transistor? (5%)

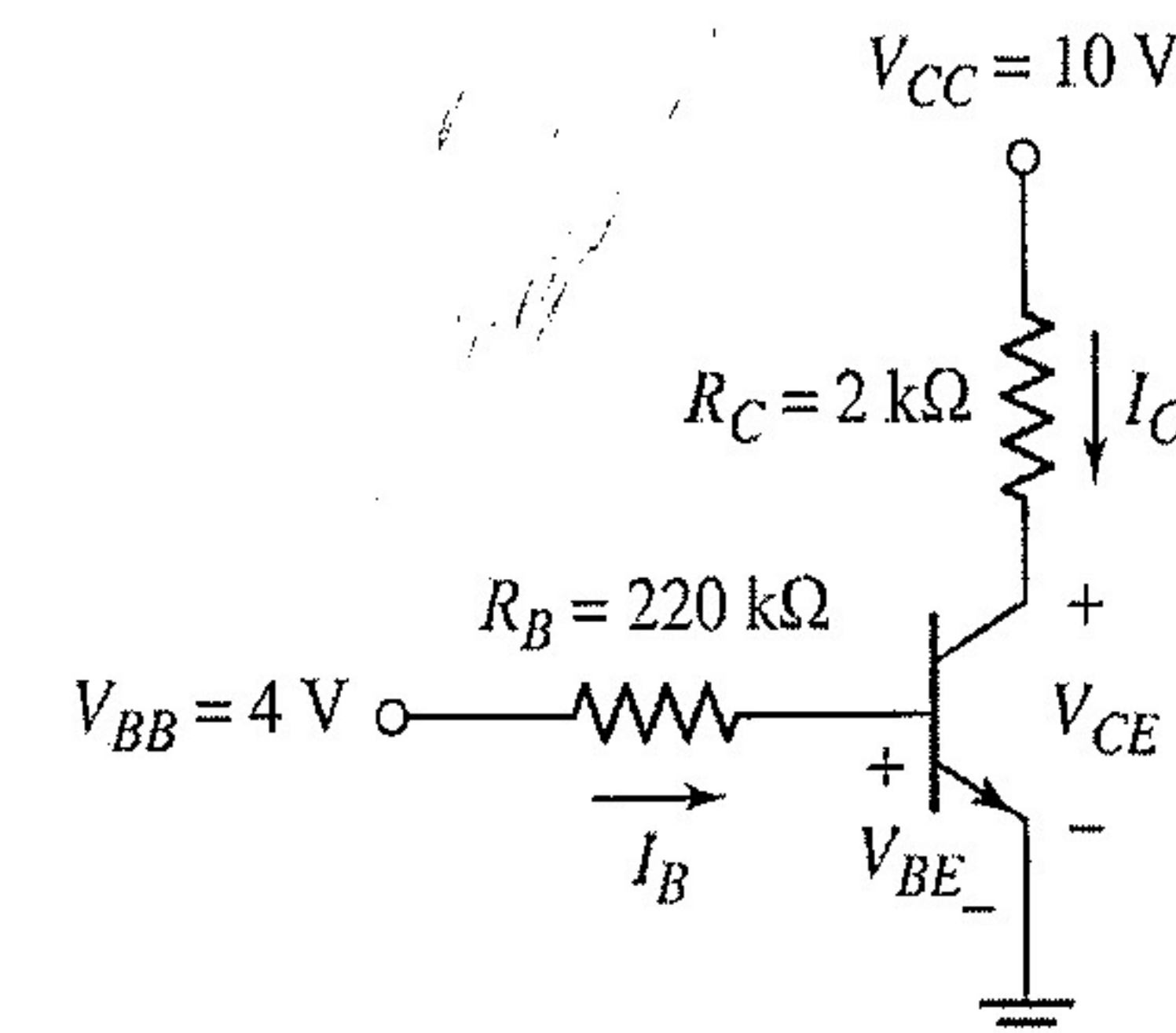


Fig.3 Transistor circuit for problem 3

注意：背面尚有試題

4. For the MOS inverter circuit shown in Fig. 4, assume the circuit values are:  $V_{DD} = 5V$  and  $R_D = 10\text{ k}\Omega$ . The threshold voltage of the transistor is  $V_{TN} = 1V$ .

- (a) Determine the value of conduction parameter  $K_n$  such that  $v_O = 1V$  when  $v_I = 5V$ . (5%)
- (b) What is the power dissipation ( $P$ ) in the transistor? (5%)

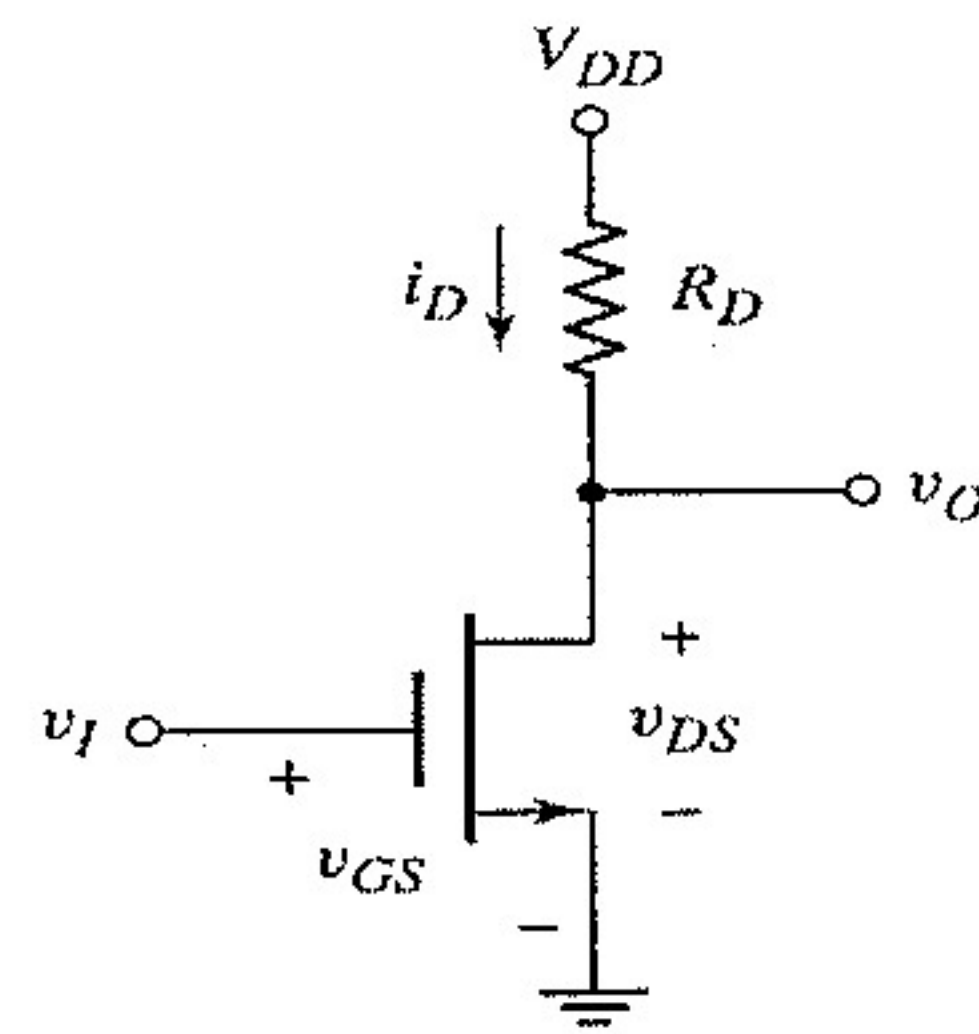


Fig.4 The NMOS inverter circuit for problem 4

5. Draw a voltage supply circuit with input AC 110 V<sub>rms</sub> and output of +5V. Please use a full-wave bridge rectifier, capacitor filter, and a three-terminal voltage regulator IC(7805) to provide an output of +5V. (10%)
6. In the voltage regulator circuit in Fig. 5, let  $V_I = 6.3V$ ,  $R_i = 12\Omega$  and reverse Zener voltage  $V_Z = 4.8V$ . The Zener diode current is to be limited to the range  $5\text{mA} \leq I_Z \leq 100\text{mA}$ .
- (a) Determine the range of possible load currents ( $I_L$ ) and load resistances ( $R_L$ ). (10%)
- (b) Determine the power rating required for the Zener diode ( $P_Z$ ) and the load resistor ( $P_L$ ). (10%)

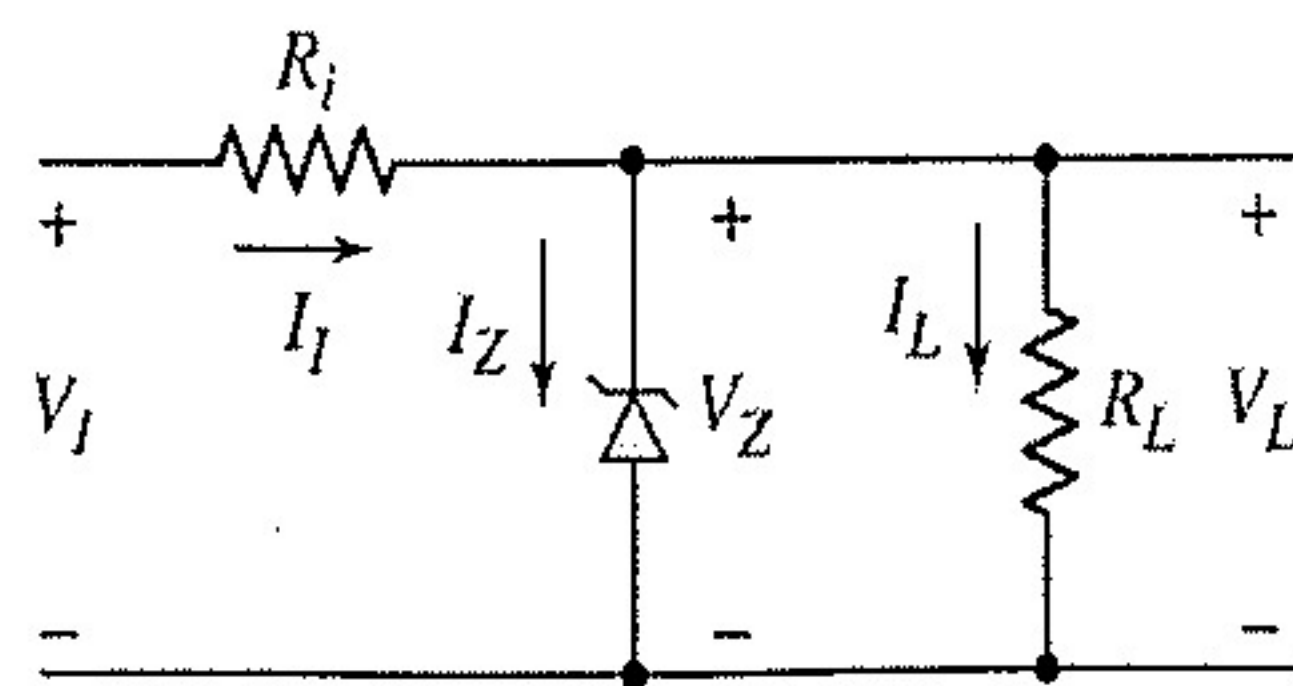


Fig.5 A voltage regulator circuit for problem 6