# 國立臺北科技大學九十八學年度碩士班招生考試

## 系所組別：1111 機電整合研究所甲組

## 第二節　電子學（選考）試題



**注意事項：**

1. 本試題共 5 題，每題 20 分，共 100 分。
2. 請標明大題、子題編號作答，不必抄題。
3. 全部答案均須在答案卷之答案欄內作答，否則不予計分。

1. For the circuit of Fig. 1, determine the range of $R_L$ and $I_L$ that will result in the voltage across the $R_L$ being maintained at 10 V. Note that $I_{ZM}$ represents the maximal allowable current of the Zener diode.

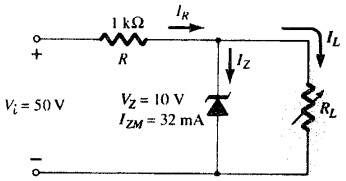


Fig. 1.

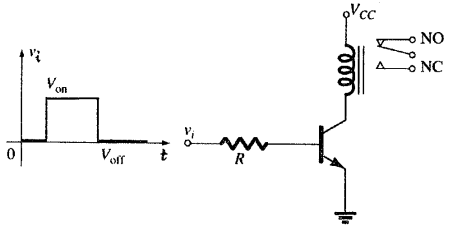


Fig. 2.

2. A relay is driven by a transistor as shown in Fig. 2. Explain which of the components will be endangered during actual operation and how to modify the circuit to avoid the possible damage.

3. For the circuit shown in Fig. 3, redraw it on your answer sheet, properly name some variables, e.g. $I_{RP}$ for the current flowing through $R_P$, and step by step derive the expression of $V_o$.

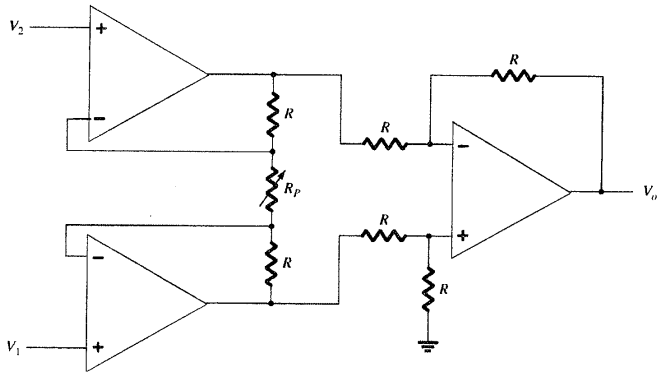


Fig. 3.

4. For the circuit shown in Fig. 4, (1) explain how to determine operating point (or Q-point) (6%); (2) plot DC and AC load lines to explain the operation of the circuit (6%); (3) derive the expressions for input power, maximal output power and maximal efficiency (8%).

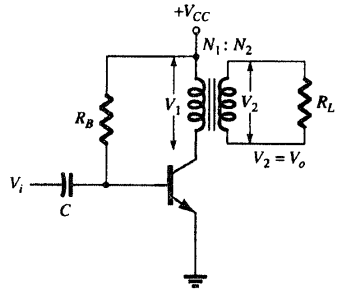


Fig. 4.

5. For an n-channel enhancement-type MOSFET, (1) draw the cross section of the transistor to explain its structure and materials, including the impurities being implanted (6%); (2) draw the cross section again but connect its terminals to proper power sources to denote the fully turn-on situation. Add some regions to explain the changes inside the transistor (6%). (3) Write an expression for the drain current of the transistor at fully turn-on situation. Explain what kinds of the factors or parameters affect the drain current (8%).