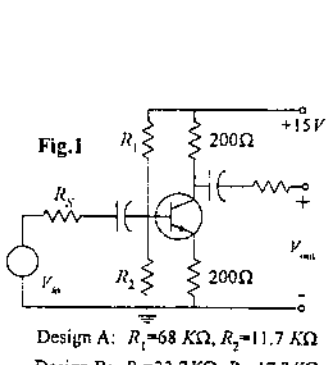
電子電路

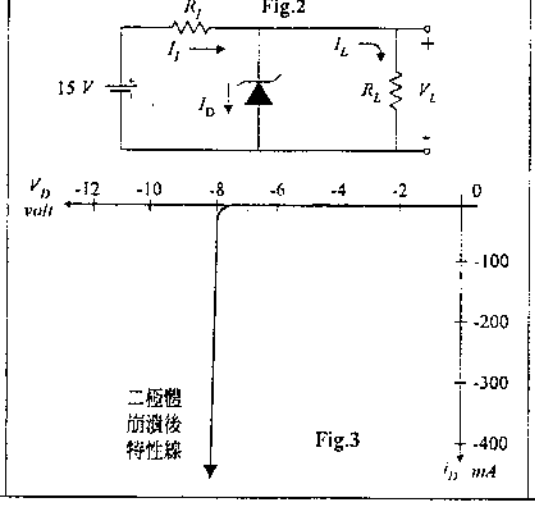
1) Determine which of the amplifier designs, design A and design B, offers the better choice of operating point for the amplifier shown in Fig.1, and explain why one is superior to the other。 (Assume that $\beta = 100$ and $V_{BE,ON} = 0.7V$) (20%)

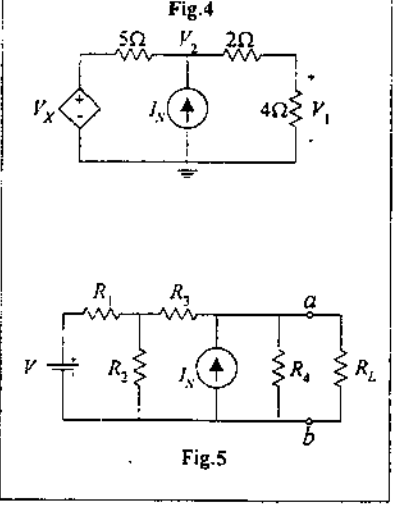
2) In Fig.2, a Zener diode is used to maintain V_L under the variation of I_L. Assume that the diode has a break down voltage of $8\,V$, and that I_L varies between $10mA$ and $100mA$.
   (a) Derive a range for R_I so that the Zener diode may maintain break down status for the specified range of I_L. (10%)
   (b) What is the maximum power dissipated by the diode? (Give the answer in terms of R_I) (5%)
   (c) Let $R_I = 30\Omega$ and assume that the characteristics of the diode after break down follow the curve shown in Fig.3. Estimate the variation in V_L as I_L varies. (10%)

3) Answer the following two questions.
   (a) Compute V_1 and the nodal voltage V_2, in Fig.4. (Note that $I_S = 0.5A$ and $V_X = 2 \times V_1$) (7%)
   (b) Compute the Thevenin equivalent voltage and the equivalent resistance seen by the load in Fig.5. (Note that $V = 5\,Volt$, $R_1 = R_2 = R_4 = 2\Omega$, $R_3 = 1\Omega$ and $I_S = 1A$) (8%)



Design A: R_1=68 KΩ, R_2=11.7 KΩ
Design B: R_1=23.7KΩ, R_2=17.3KΩ





(背面仍有題目,請繼續作答)

工程力學

Problem 1. As shown in Fig. 1, consider a point mass above the Earth of which the radius is $R_E = 6378$ km. The initial velocity of the mass on the Earth surface is $V_0 = 4000$ km/hr vertically upward. Assume that the gravity acceleration is $g = \dfrac{g_0 R_E^2}{(R_E + h)^2}$ where $g_0 = 9.8$ m/sec^2 is constant and h is the altitude of the mass. Determine the velocity V of the mass as a function of the altitude h. What is the maximum altitude the mass can reach? Compare the answer with the altitude the mass can reach if $g = g_0$. (20%)

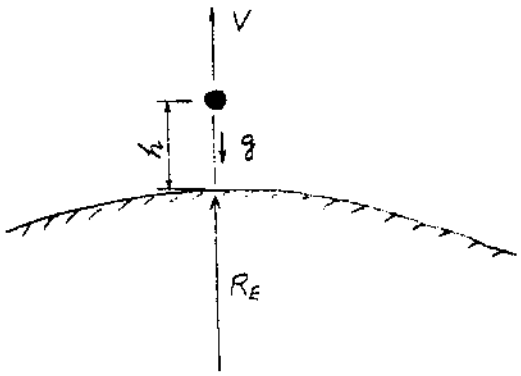


Figure 1: Schematic diagram for Problem 1.

Problem 2. A cylinder of radius R and mass m on a slope of angle ϕ is connected at the center of the cylinder by a spring with spring constant K as shown in figure 2. Consider the motion that cylinder rolls without slip.

a. Write the differential equation of motion for the system when torque T is applied to the cylinder.

b. From equilibrium position, find the angle θ that the cylinder travels when constant torque T is applied to rolls up the slope.

(20%)

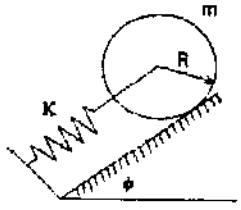


Figure 2: Schematic diagram for Problem 2.