

**Mid-term Examination**

**Date: Nov. 6th, 2015**

**Duration: 90 minutes**

<b>SUBJECT: Electronic Devices</b>	
Dean of School of Electrical Engineering Signature:	Lecturer: Tran Van Su, Msc. Signature:
Full name: Tran Van Su	Full name: Tran Van Su

**INTRODUCTIONS:**

1. Only one NOTE of A4-PAPER and calculators allowed during the exam. Books, other materials, and computers are prohibited.
2. Answer all questions.

**Question 1 (15 Marks)**

An op-amp has the frequency response of the voltage gain depicted in Fig. 1

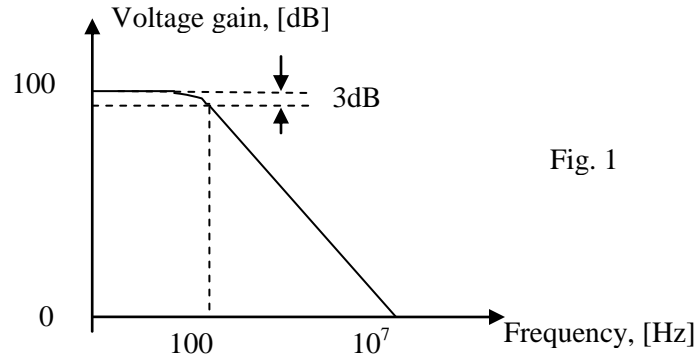


Fig. 1

- Determine the frequency response of an open-loop op amp approximated by STC form. (5 Marks)
- What is unity gain-bandwidth? (5 Marks)
- What is the bandwidth for the application with gain of 60dB? (5 Marks)

**Question 2 (10 Marks)**

An ideal op-amp is connected with resistance  $R$  and diode  $D$  shown in Fig. 2. The current of the diode is  $i_D = I_S e^{\frac{v_D}{nV_T}}$  (A). Find relationship between  $V_0$  and  $V_{in}$ . (15 Marks)

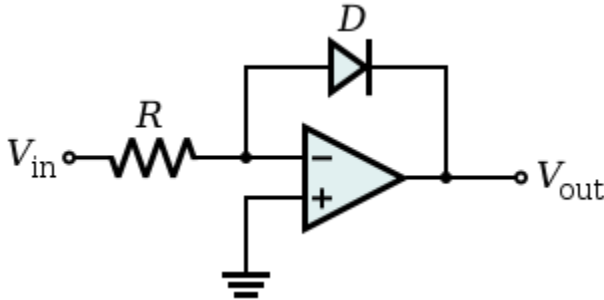


Fig. 2

**Question 3 (10 Marks)**

You are provided with an ideal op amp and three 10-k $\Omega$  resistors. Using series and parallel resistor combinations, how many different inverting amplifier circuit topologies are possible? Plot all possible circuit topologies. What is the largest (noninfinite) available voltage gain? What is the smallest (nonzero) available gain?

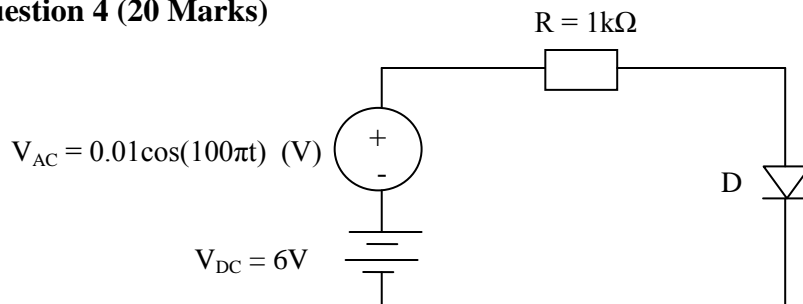
**Question 4 (20 Marks)**

Fig. 3

The constant-voltage-drop model is used for the diode (D) in Fig. 3. The ideality factor  $n = 1$ .

- Find the current  $i_D$ . (10 Marks)
- Find the voltage  $v_D$ . (10 Marks)

### Question 5 (20 Marks)

A zener diode exhibits a constant voltage of 5.1 V for current not less than 5 mA. It is to be used in the design of a shunt regulator fed from a power supply ( $V_S$ ) shown in Fig. 4. The load current varies over the range 5mA to 10 mA.

- Find minimum voltage  $V_{Smin}$ . (10 Marks)
- If  $V_S = 25V$ , compute the maximum power dissipation of the zener diode? (10 Marks)

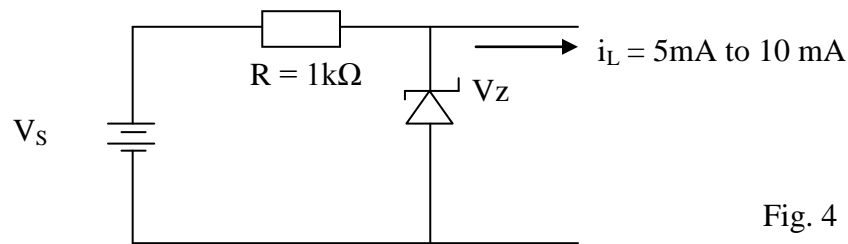


Fig. 4

### Question 6 (20 Marks)

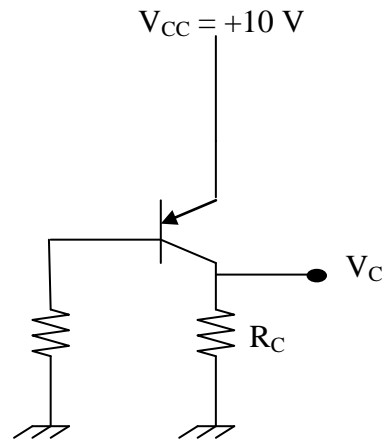


Fig. 5

The pnp transistor in Fig. 5 has  $I_S = 10^{-14}A$ , and  $n = 1$ .

- If  $I_C = 8mA$  find  $V_{EB}$  (10 Marks)
- Find the value  $R_C$  to obtain  $V_C = +7V$  (10 Marks).

### Question 7 (5 Marks)

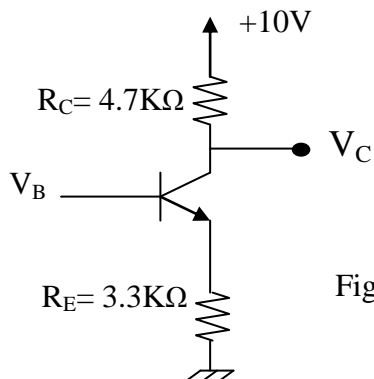


Fig. 6

Find the maximum  $V_B$  can be raised while the transistor remains in the active mode ( $V_B = V_C$ ). Assume  $\alpha = 1$  and  $V_{BE} = 0.7V$ .