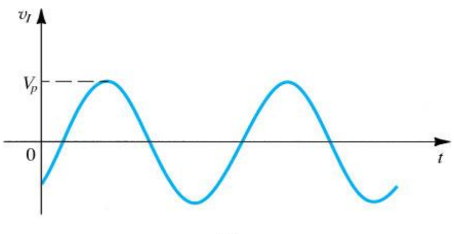
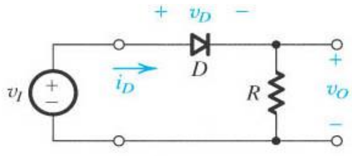
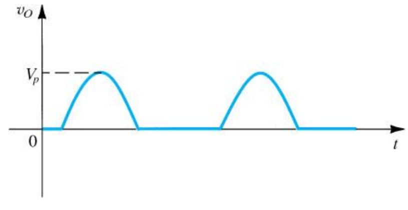
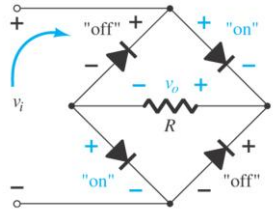
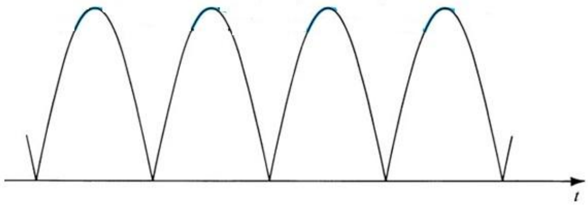
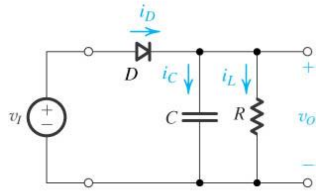
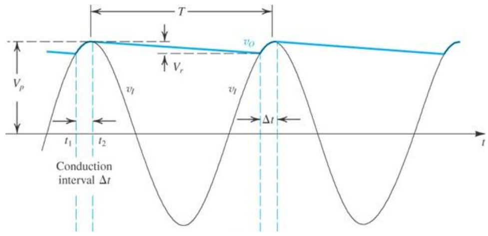
中山大学理工学院 2013 学年 2 学期 期中

12 级微电子 2+2 模拟电子技术 试卷参考答案

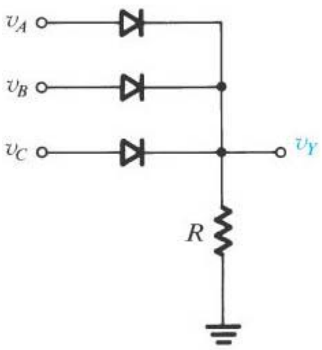
_______年级 _______专业 姓名__________学号____________

老师姓名： 考试成绩 ：

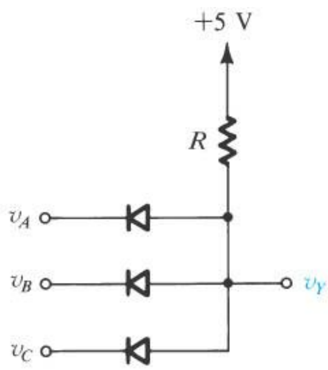
1. Assuming all diodes to be ideal, draw the output waveform for each rectifier circuit. (15%)

Input waveform	Rectifier configurations	**Output Waveforms**
		
		
		

2. Assume all diodes to be ideal. Figure out the types of the below logic gates and write the relevant truth tables (10%)



(a)

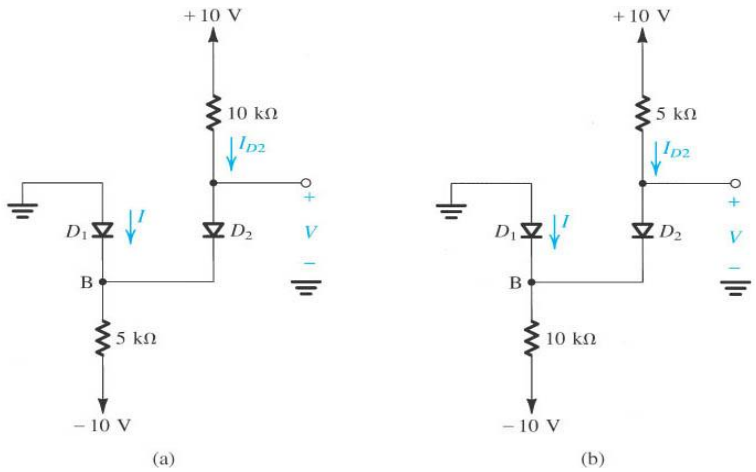


(b)

(a): **OR** gate				(b): **AND** gate			
v_A	v_B	v_C	v_Y	v_A	v_B	v_C	v_Y
0	0	0	**0**	0	0	0	**0**
0	0	1	**1**	0	0	1	**0**
0	1	0	**1**	0	1	0	**0**
0	1	1	**1**	0	1	1	**0**
1	0	0	**1**	1	0	0	**0**
1	0	1	**1**	1	0	1	**0**
1	1	0	**1**	1	1	0	**0**
1	1	1	**1**	1	1	1	**1**

Note: logic "1" means high voltage, i.e., around 5V, and logic "0" means low voltage, i.e., around 0V.

3. Assuming the diodes to be ideal, find the values of ***I*** and ***V*** in the following circuits (20%)



(a) It is easy to decide that D2 is in state ON, or V_B are supposed to be higher than10Volts, which is impossible. So we have only two assumptions to filter. One is that both D1 and D2 are on, otherwise D2 is on and D1 is off.

For the first assumption, we can get V_B=0 V, So:

$$I_{D2} = \frac{(10-0)V}{10K\Omega} = 1(mA)$$
$$V = V_B = 0(V)$$
$$I_{5K\Omega} = \frac{[V_B - (-10)]V}{5K\Omega} = 2(mA)$$
$$I = I_{5K\Omega} - I_{D2} = 1(mA)$$

This assumption is correct, and the other assumption is wrong surely. The detail steps to prove can be done by you easily as the similar method above.

(b) Compared with (a), the difference is the two resisters changed their positions. Firstly, we can also decide that the D2 is always on as the same reason in (a). Therefore, we also have only two choices.

First, we assume that D1 is on when D2 is on.

If D1 is on, V_B=0V. So:

$$I_{10K\Omega} = \frac{[0-(-10)]V}{10k\Omega} = 1(mA)$$
$$I_{D2} = \frac{10V}{5K\Omega} = 2(mA)$$
$$I = I_{10K\Omega} - I_{D2} = -1(mA) < 0$$

Since I<0, it is not consistent with our assumption. The first assumption is not correct, which mean the second assumption must be right.

Second, we can get that D1 in off when D2 is on. So I =0.

$$V = 10 - \frac{[10-(-10)]V}{15K\Omega} \times 5K\Omega = \frac{10}{3}V \approx 3.3V .$$

4. Fill in the blank areas (30%)

(1) The single-crystal formed by pure semiconductor materials is called _intrinsic__ semiconductor.

(2) The materials containing impurity atoms are called __extrinsic___semiconductors, or doped semiconductors.

(3) In *n*-type semiconductors, the impurities are from group _V__ elements, e.g. Phosphorus.

(4) In *p*-type semiconductors, the impurities are from group __III_ elements, e.g. Boron.

(5) The majority carriers in *n*-type materials are __electrons__.

(6) The minority carriers in *n*-type materials are __holes____.

(7) When doing DC analysis, the capacitor can be treated as _open__ circuit and the inductor can be treated as _short_ circuit. When doing AC analysis, the independent voltage source can be treated as _short_ circuit. (select open or short)

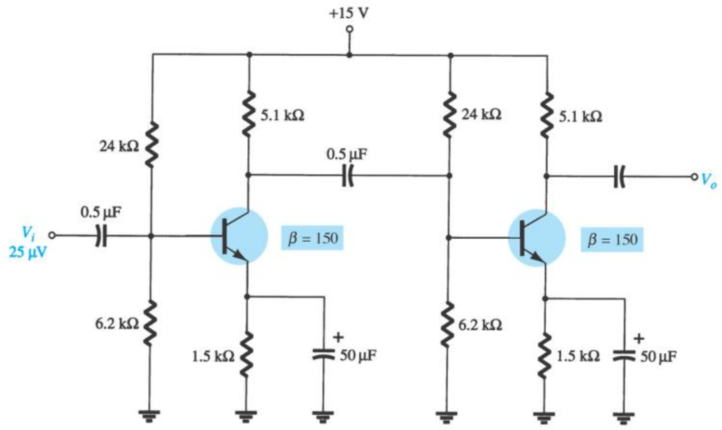
(8) The condition of a BJT working in active regions is that the BE junction is _forward_ bias and the BC junction is _reverse_ bias. As for BJT working in saturation region, the condition is that the BE junction is _forward_ bias and the BC junction is _forward_ bias. (select forward or reverse)

(9) For a BJT amplifier with common-emitter configuration, the input terminal is __base___, and the out terminal is __collector__.

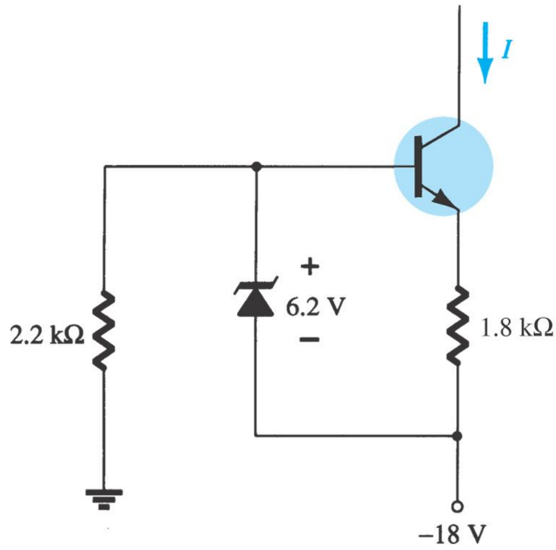
5. (20%) A BJT cascade amplifier is shown below. Assuming $V_{BE(\mathrm{on})}$ is 0.7 V,

(1) Calculate the dc bias voltages (V_B, V_C and V_E) and collector current (I_C) of each stage

(2) Calculate the input impedance, output impedance and the overall ac voltage gain.



6. Assuming $V_{BE(\text{on})}$ is 0.7 V, calculate the constant current I in the following circuit. (5%)



The End