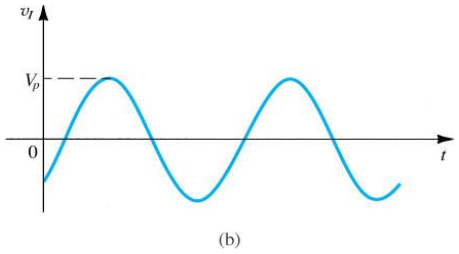
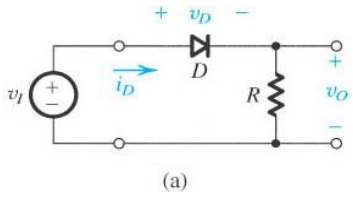
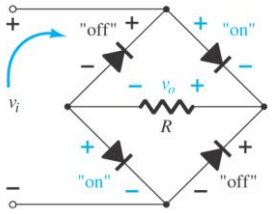
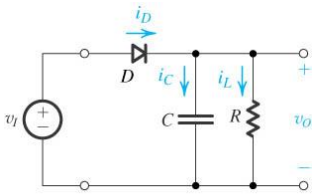
中山大学理工学院 2012 学年 1 学期期末

11 级微电子 2+2 模拟电子技术 试卷（A）

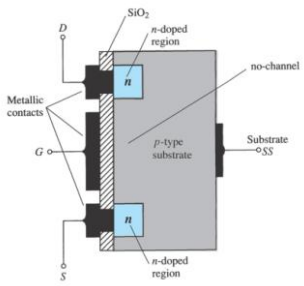
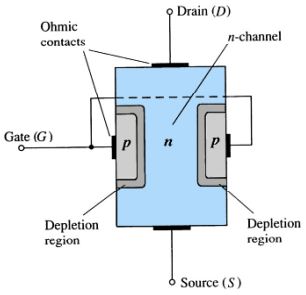
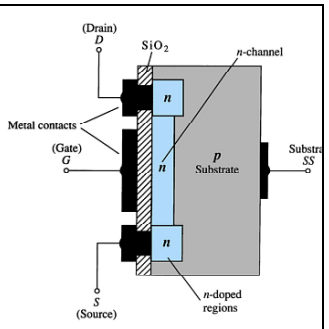
_____年级 _____专业 姓名_____学号_____

老师姓名： 考试成绩 ：

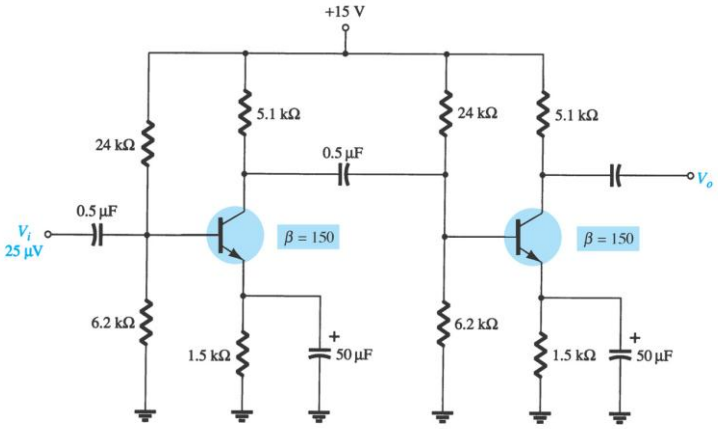
1. Assuming all diodes are ideal, draw the output waveform for each rectifier circuit. (10%)

Input waveform	Rectifier configurations	**Output Waveforms**
 (b)	 (a)	
		
	 (a)	

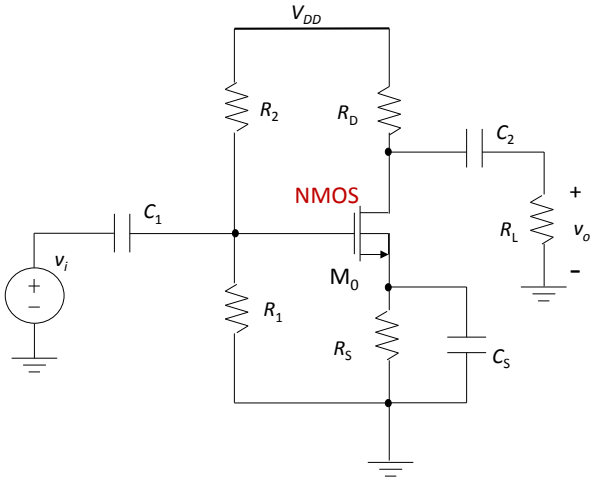
2. Fill in the blank areas (10%)

FET Structure			
FET Type			
Operation Mode (Tick your selection)	Depletion (D) ( ) Enhancement (E) ( )	Depletion (D) ( ) Enhancement (E) ( )	Depletion (D) ( ) Enhancement (E) ( )
Difference between D- and E- operations			

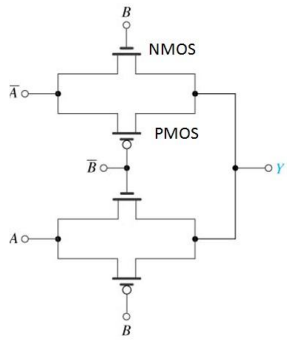
3. (15%) A BJT cascade amplifier is shown below. Assuming $V_{BE(on)}$ is 0.7 V,
   1. Calculate the dc bias voltages, collector current and voltage gain of each stage
   2. Calculate the overall ac voltage gain.



4. A single-stage amplifier with N-type enhancement MOSFET is shown below. (10%)
   (1) Draw the DC equivalent circuit.
   (2) List the equations to decide I_D and V_{DS} of NMOSFET M_0 if I-V relationship of M_0 is given as $I_{D0} = \frac{1}{2}\mu_n C_{OX}\frac{W}{L}\left(V_{GS} - V_{TH}\right)^2\left(1+\lambda V_{DS}\right)$. Ignore channel length modulation effect in this step.
   (3) Draw the AC equivalent circuit based on small-signal modeling of M_0. Write the expression of overall voltage gain (v_o/v_i). Channel length modulation effect should be included in this step.



5. Fill in the blank areas (10%)

<table>
<tr><td>Logic circuit</td><td>Truth table</td><td>Function</td></tr>
<tr><td> 
</td><td>4%
<table><tr><td>A</td><td>B</td><td>Y</td></tr><tr><td>0</td><td>0</td><td></td></tr><tr><td>0</td><td>1</td><td></td></tr><tr><td>1</td><td>0</td><td></td></tr><tr><td>1</td><td>1</td><td></td></tr></table></td><td>1%</td></tr>
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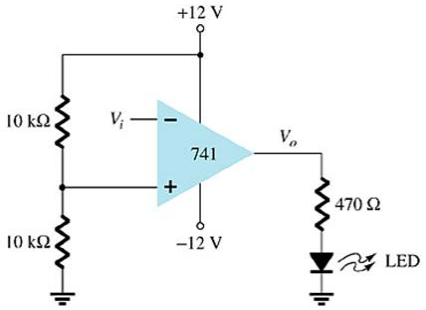
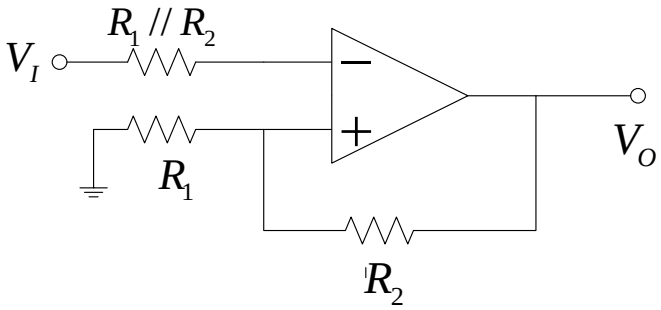
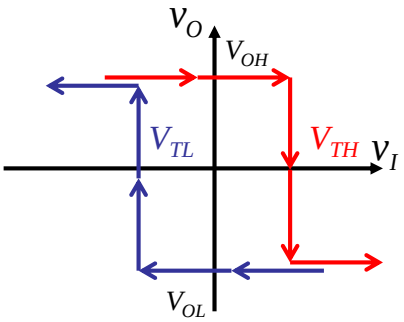
6. Comparator circuits analysis (10%)

(1) Explain the function of the circuit shown below. What will be happened if V_i is very noisy?



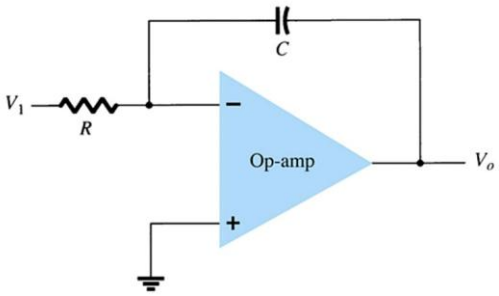
(2) Explain the function of Schmitt Trigger shown below. Why the hysteresis operation is introduced in this configuration?





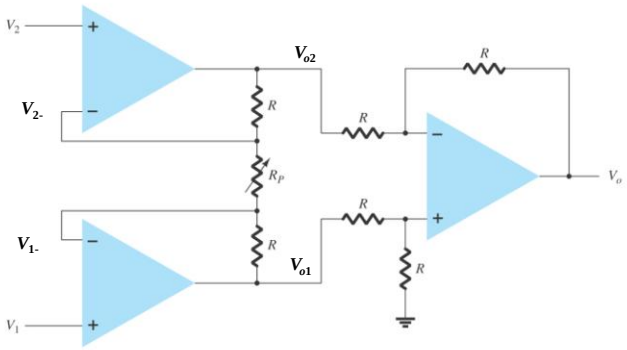
7. Op-Amp application circuits (20%)

（1） Find the relationship between V_1 and V_o (5%)



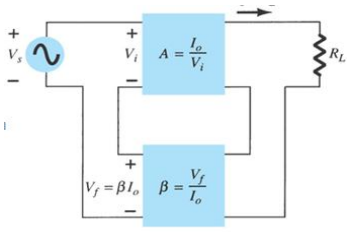
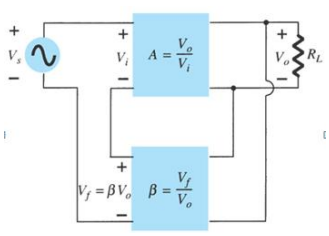
（2）For the instrumentation amplifier circuit shown below, R = 5 kΩ, R_P = 500 Ω, and all operaional amplifiers are ideal. (15%)

a. Find the relationship between V_1,V_2 and V_{o2}
b. Find the relationship between V_1,V_2 and V_{o1}
c. Find the relationship between V_{o1},V_{o2} and V_o
d. Find the value of V_o if V_2 = 10 V and V_1 = 5 V



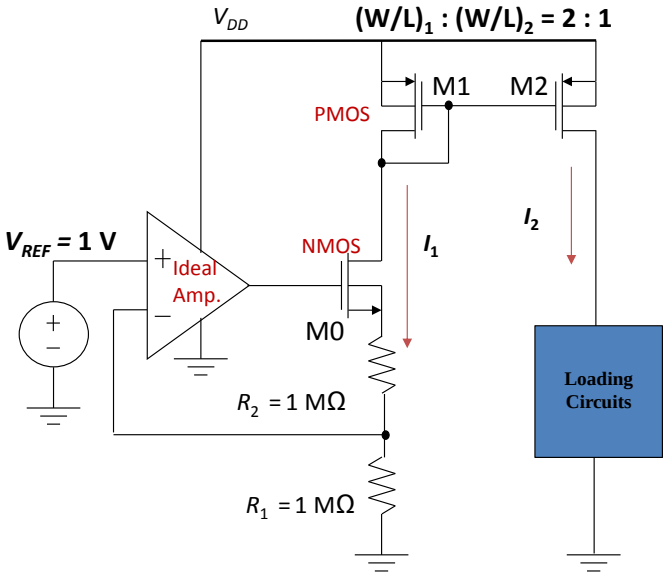
8. Feedback types and feedback circuit analysis (15%)

(1) Fill in the blank areas

Feedback configurations		
Feedback type		
Close-loop gain		
Close-loop R_{in}		
Close-loop R_{out}		

(2) A CMOS circuit with negative feedback configuration is shown below. Assuming the amplifier is ideal and all enhancement MOSFTEs are working in saturation mode.

a. Find the values of I_1 and I_2
b. Comments on the circuit function
c. What is the feedback type?



The End