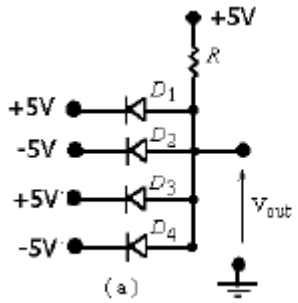
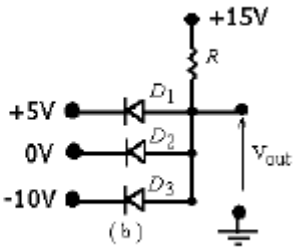
Department of Electrical Engineering

Electronics I (63260)

First Exam - March 2009
Time Allowed: 50 Mins
Answers

[1] In the following circuits and assuming that **all the diodes used are of Silicon type** , Determine which diode is forward biased and which is reversed biased as well as the value of Vout , in both circuits by completing the following tables





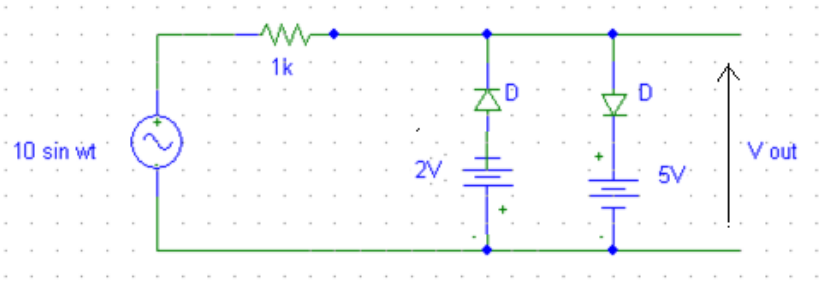
For circuit (a): 2 Marks

Diode	Forward or Reverse biased	
D1	*Reverse*	*Vout = - 4.3 V*
D2	*Forward*	
D3	*Reverse*	
D4	*Forward*	

For circuit (b): 2 Marks

Diode	Forward or Reverse biased	
D1	*reversed*	*Vout= - 9.3 V* Since D3 become the first to switch on , Vout will assume a value of – 9.3 V . This value causes the other two diodes (n D1 , D2) to become reversed biased
D2	*Reversed*	
D3	*Forward -first to switch on*	

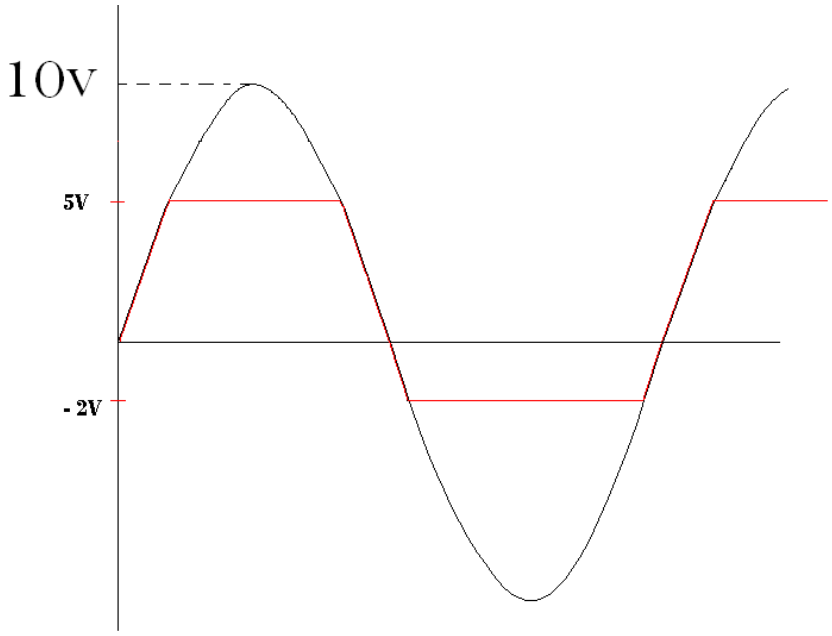
[2] In the following circuits, **fill in the table**, **sketch the output signal indicating all voltage levels** and **describe the function of each circuit**
(a)



2 Marks

Vi	**0**	1	**3**	**6**	**- 1**	**- 3**	**- 9**
Vout	0	1	3	5	-1	-2	-2

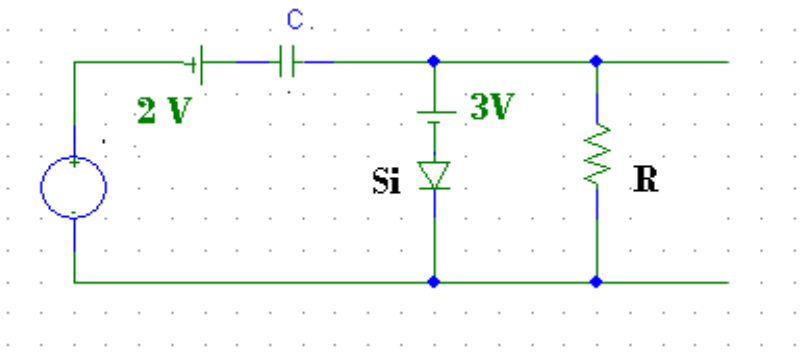
Sketch the output wave form on top of the input **1 Marks**



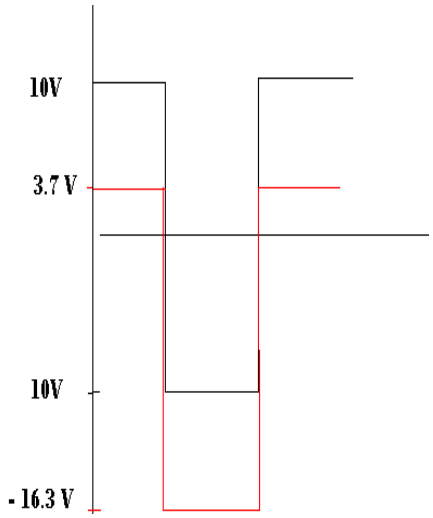
Description of the circuit: **1 Mark**

This is a clipper circuit: The input waveform is clipped above 5 V and below -2 V

(b)



Sketch the output wave form on top of the input one **2 Marks**



Description of the circuit: **1 Mark**
This is a clamp circuit: the input waveform is clamped between 3.7 and -16.3 Volts

[3]

Mark the correct answer for the following questions: **5Marks**

[**1]** Referring to the atomic structure of a particular, The **Pauli's exclusion principle** states that,
(a) More than one electron can exist at any one energy level
(b) Only one electron can exist at any one energy level
(c) Only one shell can exist at any one energy level

[2]
(a) A valance electron exist at the outer shell
(b) A valance electron exist at the inner shell

(c) A valance electron exist at the middle shell

[3]
(a) Doped silicon is called intrinsic material
(b) Pure silicon is called intrinsic material
(c) The actual doping materials are called intrinsic materials

[4]
(a) The impurities in the n type materials are called acceptor atoms
(b) The impurities in the p type materials are called acceptor atoms
(c) The silicon atoms in the n type materials are called acceptor atoms

[5]
(a) The depletion layer has some charge carriers
(b) The depletion layer has majority charge carriers
(c) The depletion layer has no charge carriers

[6] In Junction diode, and for a particular forward voltage Vd ,as the temperature increases
(a) The forward current stays the same
(b) The forward current decreases
(c) The forward current increases

[7]In Junction diode, as the forward voltage is increased, the capacitance that exist across the depletion layer;
(a) Increases
(b) Stays the same
(c) Decreases

[8] The full wave rectifier circuit;
(a) Has Lower DC level than that for the half wave
(b) Has bout the same DC level as that for the half wave
(c) Has higher DC level than that for the half wave

[9] The clipper circuit;
(a) Fixes the input waveform at a particular level
(b) Cuts the input waveform at a particular level
(c) Cleans the waveform from noise

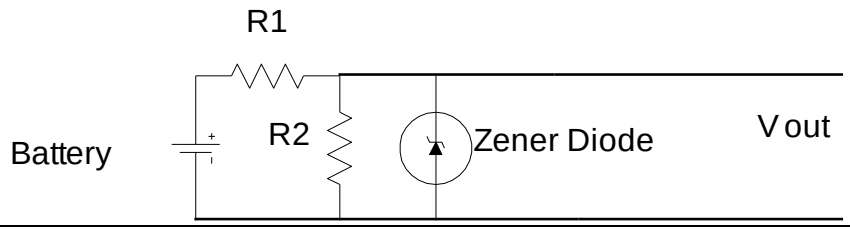
[10] As the operating temperature is increased, the diode leakage (reverse) current is;
(a) Decrease
(b) Increase
(c) Does not change

[4]

(a) Define how the Zener Breakdown occurs **2 Marks**

The N and P layer (making up the diode) are doped heavily in such away as when the diode is reversing biased (and for low voltage values), the depletion layer width remains very thin. Consequently a very strong Electrostatic force develops across the junction of the diode. Causing the depletion layer to become ionized and therefore conductive

(b) In the following circuit , if the zener voltage is 8 volts and the battery voltage is 20 volts determine the range of R1 /R2 for which the output voltage remains regulated (at 8 volts) . Assuming no limit is set for $I_{Z\,max}$ and IZK=0 **3 Marks**



Using the potential divider principle, then we may write:

$20 * R2/[R1 + R2] \geq 8$

$20\,R2 \geq 8\,R1 + 8\,R2$

i.e. $R1/R2 \leq 1.5$

Because there is no limit imposed for $I_{Z\,max}$, then for voltage regulation ;

$(R2 / R1) \geq 1.5$

Also since that resistive values never go negative then

$0 \leq (R2 / R1) \geq 1.5$