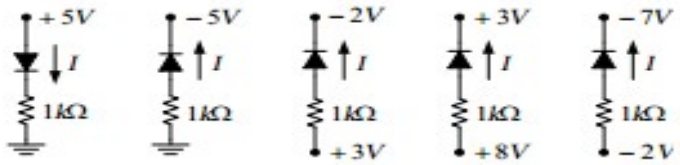
Diode Switching Circuits

:Basic Concepts

Diode switching circuits typically contain two or more diodes, each of which is connected to an independent voltage source. Understanding the operation of a diode switching circuits depends on determining which diodes, if any , are forward biased and which, if any, are reverse biased. The key to this determination is remembering that ***a diode is forward biased only if it's anode is positive with respect to it's cathode*** (see Fig. 2-1). One of the very important applications of diode switching circuits is logic gates .

Fig. 2-1

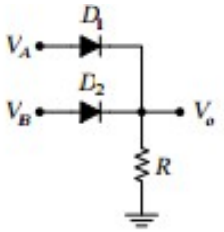


Logic Gates:

Diode can be used to form logic gates, which perform some of logic operations required in digital computers

OR Gate:

It has output when there a signal in any input channels (see Fig. 2-2).

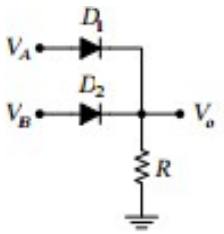


Input voltage		State of diodes		Output voltage
V_A	V_B	D_1	D_2	V_o
0	0	off	off	0
0	1	off	on	1
1	0	on	off	1
1	1	on	on	1

Fig. 2-2

AND Gate:

It has output only when all inputs are present (see Fig. 2-3).



Input voltage	State of diodes	Output

				voltage
V_A	V_B	D_1	D_2	V_o
0	0	on	on	0
0	1	on	off	0
1	0	off	on	0
1	1	off	off	1

Fig. 2-3

Example 2-1:

Determine which diodes are forward biased and which are reverse biased in the circuit shown in Fig. 2-4. Assuming a 0.7-V drop across each forward-biased diode, determine the output voltage V_o .

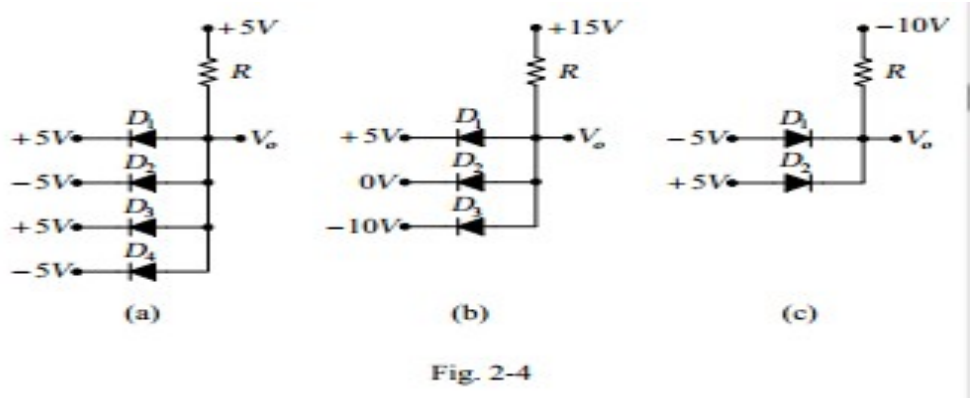


Fig. 2-4

Solution:

In (a) the net forward-biasing voltage between supply and input for each diode is

$D_1 \circ D_3 : 5 - 5 = 0\,V$

$D_2 \circ D_4 : 5 - (-5) = 10\,V$

Therefore, $D_2 \circ D_4$ are forward biased and $D_1 \circ D_3$ are reverse biased.

$V_o = -5 - 0.7 = -4.3\,V$.

While in (b) the net forward-biasing voltage between supply and input for each diode is

$D_1 : 15 - 5 = 15\,V$,

D_2 : 15 − 0 15 V ,

D_3 : 15 − − 10 25 V .

Therefore, D_3 is forward biased and D_1 D_2 are reverse biased.

V_o − 10 0.7 − 9.3 V .

Finally, in(c) the net forward-biasing voltage between supply and input for each diode is

D_1 :− 5 − − 10 5 V ,

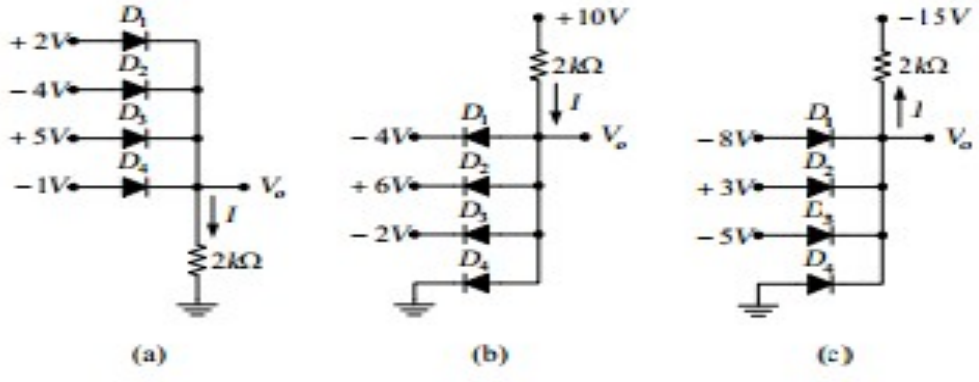
D_2 : 5 − − 10 15 V .

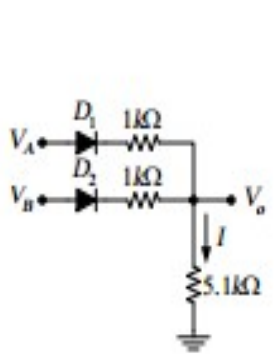
Therefore, D_2 is forward biased and D_1 is reverse biased.

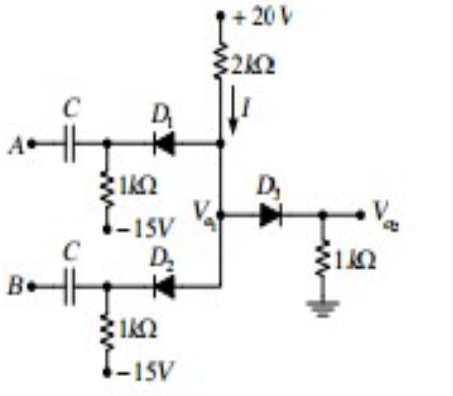
V_o 5 − 0.7 4.3 V .

Exercises:

Determine V_o and I for each circuit in Fig. 2-5. Assume that each diodes in these circuits has a forward voltage drop of 0.7 v.







1. $V_A = V_B = 0\,V$
2. $V_A = V_B = 5\,V$
3. $V_A = 0\,V$ or $V_B = 5\,V$

(d)

1. No pulses at either A or B
2. A 30V positive pulse at A or B and
3. Positive pulses (30V) at both A and B.

(e)