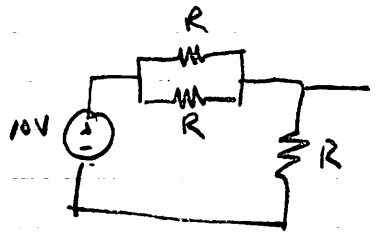
Practice Exam #2 Soln's

1) From the equation raising T has the same effect as lowering V_D. Increasing T will reduce the current that flows effectively raising the resistance of the diode.

2) a find V_{out} V_{cap} i_{cap} i_{R_3} w/ $V_s = +10V$ - which implies the diode will conduct and the cap will be charged w/ no current flowing so the equivalent circuit is



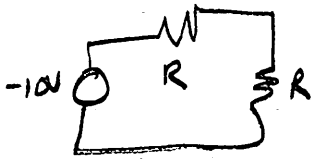
voltage divider

$V_{out} = \frac{R}{R + R/2} 10V = \frac{2}{3} 10V = 6.7V$

this is also V_{cap}, $i_{cap} = 0$

$i_{R_3} = \frac{V_{out}}{R} = \frac{1}{R} 6.7V$

b) here $V_s = -10V$ and the diode will not conduct, cap will be full so

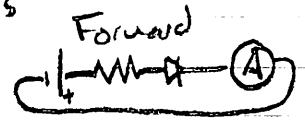


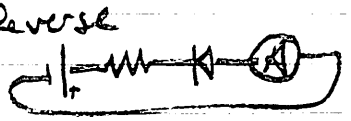
$V_{out} = \frac{R}{2R}(-10V) = -5V = V_{cap}$

$i_{cap} = 0$, $i_{R_3} = \frac{V_{out}}{R} = \frac{1}{R} 5V.$

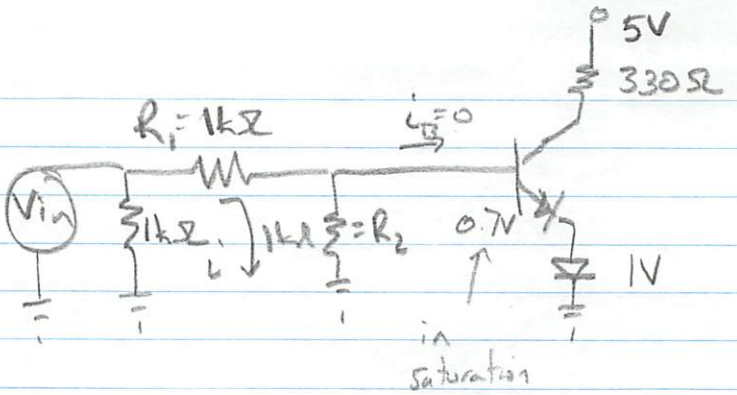
3) In the forward biased state there is no difference, it is in the reverse-biased state that things change. Regular diodes never conduct (in principle) or only do so catastrophically (in practice). Zener diodes break down non destructively and pass current w/ a voltage drop V_z across the device.

Experimentally, both will conduct forward biased @ ~ 0.7V reverse biased the zener will conduct at a moderately high reverse bias





4] 3.18 a)

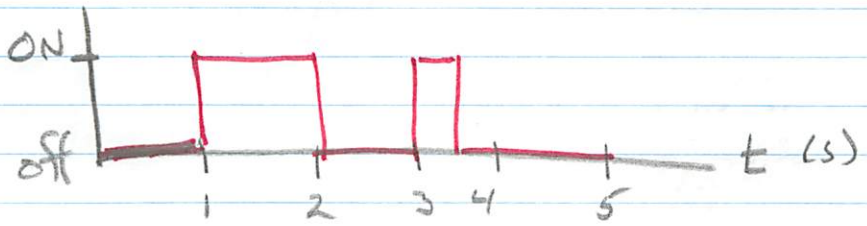


in on state

$V_b = 1.7V = i\ 1k\Omega \Rightarrow i = 1.7mA$

$V_{in} = i(2k\Omega) = 3.4V$ (there are 2 resistor in series w/ current i between V_{in} & ground)

So, if $V_{in} < 3.4V$ LED is off, if $V_{in} > 3.4V$ LED is on,



b) Now w/ $\beta \neq \infty$, $\beta = 100$

$\beta i_b = i_c$

And in saturation the voltage across the collector resistor is

$V_{R_c} = 5V - 1V - 0.2V$

$= 3.8V = i_c R$

$i_c = \frac{3.8V}{330\Omega} = 11.5mA$

so $i_b = i_c/\beta = 0.115mA$

Now $V_{in} = (i + i_b)R + iR = (2i + i_b)R$

to turn ON in saturation

$= (2 \times 1.7mA + 0.115mA)\ 1k\Omega$

$= 3.5115mA \times 1k\Omega$

$= 3.512V$ vs $3.4V$,

5) The transistor is an n-channel Mosfet transistor. The diode is there as a fly back diode to protect the transistor from damage from arcing when the transistor is shut off ($V = L\,di/dt$).

6) a) No, it is not even periodic

b) yes and $\omega_0 = 1.8\ rad/s$

c) No, the frequencies of the terms are not integer multiples of a fundamental frequency ω_0.

d) yes, $\omega_0 = 1.8\ rad/s$.

7) There are 2 bands w/ $\omega_{L_1} = 1.5\ rad/s$ $\omega_{H_1} = 2.9\ \frac{rad}{s}$

$\omega_{L_2} = 6.1\ rad/s$ $\omega_{H_2} = 10.2\ \frac{rad}{s}$

this assumes response is V_{out}/V_{in}

8) a) No - no oscillation
b) No - no oscillation
c) possible, if system is underdamped otherwise it is just a decay like for 1st order.

9)