I-1 (10 pts) 2 points each part.
True (T) or False (F). Circle your selected response.
Respond to the statements as written. Do not edit them before responding.

1) When operating in forward bias, an ideal diode has a voltage drop of 25 [mV]. 1) T or F

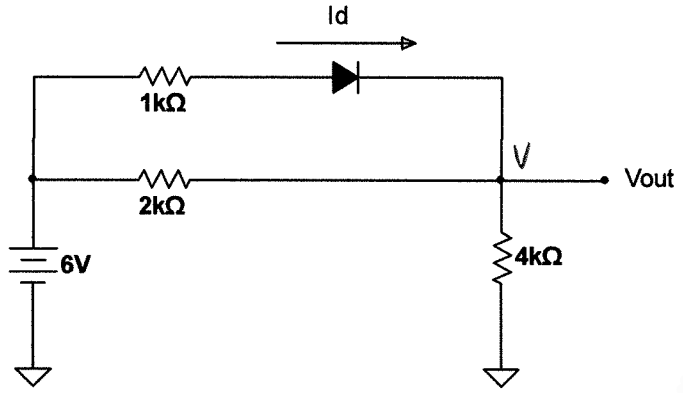
2) A BJT operating in saturation has large values of both $I_C$ and $V_{CE}$. 2) T or F

3) To a very good approximation, if a MOSFET in deep triode has its $V_{DS}$ doubled, its $I_D$ will also double. 3) T or F

4) Zener diodes are designed to operate in breakdown. 4) T or F

5) To increase the AC gain magnitude of a BJT common emitter amplifier, a designer can either increase the emitter resistor $R_E$ or decrease the collector resistor $R_C$. 5) T or F

I-2 (10 pts)
Find $I_D$ in the circuit below, using $I_S = 10^{-15}$ [A], $V_D = 0.65$ [V], $V_T = 25$ mV, and n = 1 in the diode equation. (See equation sheet, third line from the bottom.) Use this $I_D$ value to find a value for $V_{out}$.

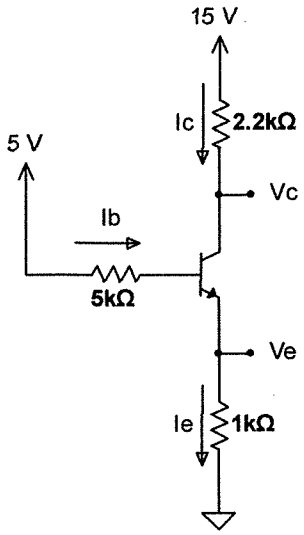



$I_D$ = _____

$V_{out}$ = _____

Please do not mark in this box ==========>>

I-3 (10 pts) Find values for all indicated quantities. Use $V_{be} = 0.7$ [V] and $\beta = 50$.




$I_b =$ 76.8 μA

$I_e =$ 3.92 mA

$I_c =$ 3.84 mA

$V_C =$ 6.55 V

$V_E =$ 3.92 V

I-4 (10 pts)

A PMOS transistor has : $V_{OV} = 0.3$ [V], $\mu_p C_{ox} = 100$ [μA/V$^2$], L = 0.18 [μm], W = 7.0 [μm], and $\lambda = 0$. It is operating in saturation. The source is connected to a 2 [V] DC supply. The gate and drain are connected directly to each other. There is a resistor $R_D$ connected from the drain terminal to ground.

4 a) Draw the schematic for this circuit. 6 b) Calculate the value of the drain current $I_D$.

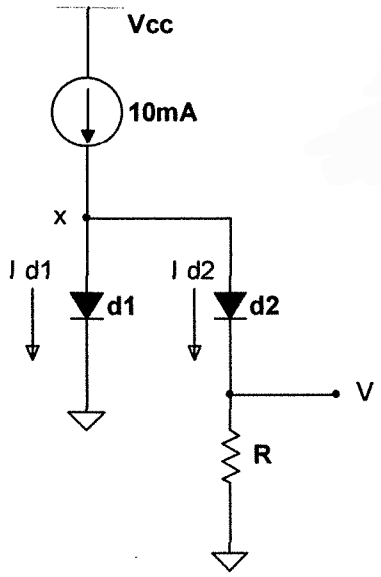
a) schematic

b) $I_D =$ 175 μA

Please do not mark in this box ==========>>

II-1 (30 pts)

In the circuit below, the diodes are identical and are governed by the exponential diode model with thermal voltage $V_T = 25$ [mV] and $Is = 10^{-15}$ [A]. Find the values of the diode currents. Find the value of R for which V = 80 [mV]. Calculate the node voltage at x.




8 $I_{d1}$ = 9.61 mA

8 $I_{d2}$ = 392 μA

7 R = 204 Ω

7 $V_x$ = 747 mV

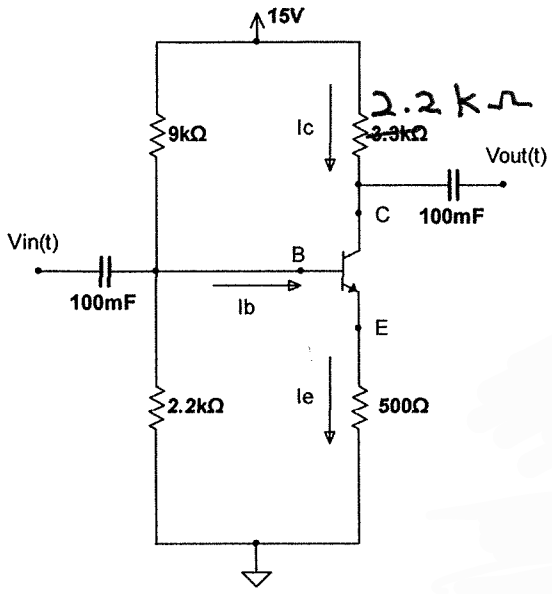
Please do not mark in this box ==========>>

II-2 (30 pts)

*Find values for all indicated quantities.*

The transistor has $\beta = 125$, $V_{be} = 0.65$ [V] and $V_t = 24$ [mV]. AC input $Vin(t) = 3\sin(1000\pi t)$ [mV]. → $|V_{in}| = 3$ m

Hint: Replace the DC bias network with a Thevenin equivalent, $V_{BB}$ and $R_B$.




$I_b =$ 35.4 μA

$I_c =$ 4.43 mA

$I_e =$ 4.47 mA

$V_{CE} =$ 3.02 V

$r_e =$ 5.37 Ω

$A_v =$ −4.35 [1/1

$|Vout(t)| =$ 13.1 mV

Please do not mark in this box ==========>>