Date ....

Tutorial - I

1(a) $T_K = 20 + 273 = 293$

$K = 11,600/n = 11600/2$ (low value of V_D)

$= 5800$

$I_D = I_S\left(e^{\frac{KV_D}{T_K}} - 1\right)$

$= 50 \times 10^{-9}\left(e^{\frac{5800 \times 0.6}{293}} - 1\right)$

$= 7.197\, mA$.

1(b) $T_K = 20 + 273$

$K = 11600/n = 11600/2 = 5800$

$I_D = I_S\left(e^{\frac{KV_D}{T_K}} - 1\right) = \cancel{\infty}$

$= 10^{-6} \times 0.1\left(1.07 \times 10^{-86} - 1\right)$

$I_D = I_S = 0.1\, \mu A$.

2(a) At $I_D = 15\, mA$, $V_D = 0.82\, V$

$R_{DC} = \frac{V_D}{I_D} = \frac{0.8V}{15mA} = 54.67\, \Omega$

2(b) $V_D = -10\, V$, $I_D = I_S = -0.1\, \mu A$.

$R_{DC} = \frac{V_D}{I_D} = 100\, M\Omega$

$V_D = -30V$, $I_D = I_S = -0.1\, \mu A$.

$R_{DC} = \frac{V_D}{I_D} = 300\, M\Omega$.

Spiral

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3. $I_D = 1mA$

$r_d = \frac{\Delta V_d}{\Delta I_D} = \frac{0.72 - 0.61}{2 - 0} = 55\ \Omega$

$I_D = 15mA$

$r_d = \frac{\delta V_d}{\Delta I_d} = \frac{0.8 - 0.78}{20 - 10} = 2\ \Omega$

4. (a) $I = 0\ mA$; diode reverse biased

(b) $V_{20\Omega} = 20 - 0.7V = 19.3\ V$ (Kirchhoff's voltage law)

$I = \frac{19.3}{20} = 0.965A$.

(c) $I = \frac{10V}{10\Omega} = 1A$ center branch open.