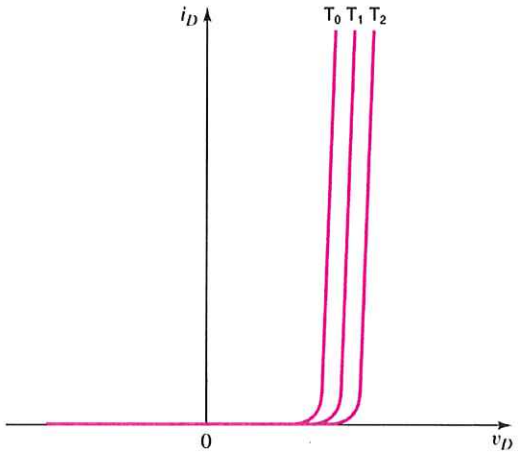
ENEL 469: Analog Electronic Circuits
Quiz-1, Fall 2023
Total marks: 28; Time: 11:00 am – 12:30 pm

ID (Optional)	**First Name (PRINT)**	**Last Name (PRINT)**

1. [**Total 10**] Circle True or False for the following statements.
   a) [**2**] The following temperature relationship satisfies the given IV characteristic curves.

      $T_2 > T_1 > T_0$

      Answer: True (False)

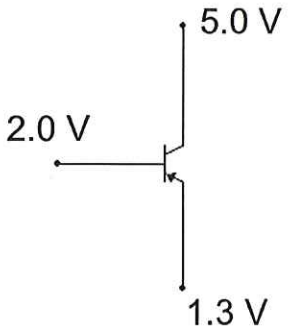


   b) [**2**] The direction of the electric field due to the depletion region changes when the biasing across the diode junction changes from forward to reverse or vice versa.

      Answer: True (False)

   c) [**2**] For the transistor biasing shown below, the E-B junction is forward-biased, and the C-B junction is reverse-biased.

      Answer: True (False)



d) [**2**] For an npn transistor, the holes in the base region can easily cross the collector-base (C-B) junction despite the reverse bias applied to the C-B junction.

Answer: True (False)

e) [**2**] For a pnp transistor, the collector current is slightly higher than the emitter current.

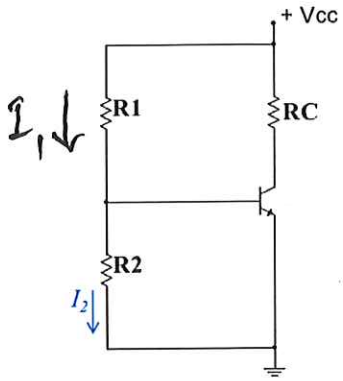
Answer: True (False)

2. [**3**] The base-emitter junction of a pnp transistor is reversed biased by 2.0 V, and the common-emitter current gain β of the transistor is 80. Determine the collector current I_C of the transistor in mA. Ignore all leakage currents in your calculation.

Ans: I_C = 0 mA

3. [**Total 5**] Consider the following circuit, where V_{CC} = 12 V, V_{CE} = 6 V, R_C = 1.5 kΩ, β = 110, $V_{BE(on)}$ = 0.7 V, $V_{SE(Sat)}$ = 0.2 V and I_2 = 80 μA. Determine the value of the resistor **R_1 in kΩ**.

Soln:



$$I_c = \frac{V_{cc} - V_{CE}}{R_c}$$

$$I_c = 4\ mA$$

$$I_B = \frac{I_c}{\beta} = 36.4\ \mu A$$

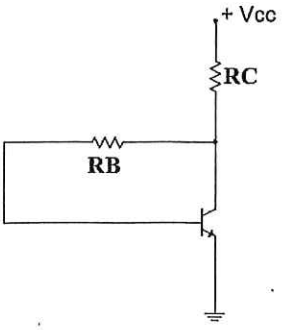
Thus, $I_1 = I_B + I_2 = 116.4\ \mu A$

$$R_1 = \frac{V_{cc} - 0.7}{I_1}$$

$$\boxed{R_1 = 97.1\ K}$$

Ans: R_1 = 97.1 kΩ

4. [**Total 10**] Consider the given circuit. Given, $V_{BE(on)}$ = 0.7V, β=52, V_{CC} = 14V, R_C = 2 kΩ, and R_B = 175 kΩ.



a) [**4**] Determine the collector current I_C **in mA** for the given circuit. Do not consider $I_C = I_E$

$$V_{CC} = I_E R_C + I_B R_B + V_{CE(on)}$$

$$\text{or, } I_B = \frac{V_{CC} - 0.7}{R_B + (\beta+1)R_C}$$

$$I_B = 47.3\ \mu A$$

$$\text{Thus, } \boxed{I_C = 2.46\ mA}$$

Ans: I_C = 2.46 mA

b) [**3**] The collector-emitter voltage V_{CE}.

$$V_{CE} = V_{CC} - I_E R_C$$

$$= 8.99\ V$$

Ans: V_{CE} = 8.99 V

c) [**2**] The collector-base voltage V_{CB}.

$$V_{CB} = V_{CE} - 0.7$$

Ans: V_{CB} = 8.29 V