

University Electrical Engineering

Name: _____ Score: _____

1. A pn junction is forward biased when the n side is more positive than the p side.
☐ True ☐ False
2. A half-wave rectifier's output never reverses direction.
☐ True ☐ False
3. The BJT stays in the active region as long as
☐ $V_{CE} > 0 \text{ V}$
☐ $V_{BE} > 0.7 \text{ V}$
☐ $I_C > I_B$
☐ $V_{CE} > \text{about } 0.2 \text{ V}$
4. An n-channel MOSFET with $V_t = 1.5 \text{ V}$ and $v_{GS} = 1.0 \text{ V}$ conducts a small drain current set by the square law.
☐ True ☐ False
5. In the small-signal model, a DC supply rail becomes signal ground.
☐ True ☐ False
6. An inverting stage has $R_{in} = 10 \text{ k}\Omega$ and $R_f = 90 \text{ k}\Omega$. What is β_{fb} ?

7. A $1 \mu\text{F}$ coupling capacitor sees $10 \text{ k}\Omega$. What is f_L , in Hz?
_____ Hz
8. Ten times the diode current costs how much extra voltage ($n = 1$)?
☐ 120 mV
☐ 0.7 V
☐ 26 mV
☐ about 60 mV
9. Each bridge diode must survive a peak inverse voltage of about
☐ the ripple
☐ 0.7 V
☐ one secondary peak (17 V here)

☐ twice the peak

10. A bias divider has $R1 = 47 \text{ k}\Omega$ to a 10 V supply and $R2 = 10 \text{ k}\Omega$ to ground. What is V_B , in volts, ignoring base current?

_____ V

1. **False**

Forward bias puts the p side positive. With the n side positive the depletion region widens and the junction blocks.

2. **True**

The diode blocks the negative half-cycles, so the load current only ever flows one way. It is DC in direction, though far from steady.

3. **$V_{CE} > \text{about } 0.2 \text{ V}$**

Saturation starts at about $V_{CE} = 0.2 \text{ V}$, with both junctions forward biased. Checking $V_{CE} > 0$ lets a saturated transistor pass as an amplifier.

4. **False**

$v_{GS} < V_t$, so no channel forms: the device is cut off. The square law applies only above threshold, in saturation.

5. **True**

A constant voltage has no wiggle, so for the signal it behaves as a short to ground. The same holds for large coupling and bypass capacitors at signal frequency.

6. **0.1**

$\beta_{fb} = \frac{10}{10 + 90} = 0.1$. The ideal gain is -9 ; with $A_{OL} = 10^5$ the loop gain is 10^4 .

7. **15.9 Hz**

$\frac{1}{2\pi \times 10^4 \times 10^{-6}} = 15.9 \text{ Hz}$.

8. **about 60 mV**

$\ln 10 \times V_T = 2.303 \times 26 = 59.9 \text{ mV}$. This steepness is why the 0.7 V model works; with $n = 2$ it would be 120 mV.

9. **one secondary peak (17 V here)**

The pair that is off sees one full secondary peak, $12\sqrt{2} = 17 \text{ V}$. Rate the diodes above that.

10. **1.75 V**

$10 \times \frac{10}{57} = 1.75 \text{ V}$. Its Thévenin resistance is $47 \text{ k} \parallel 10 \text{ k} = 8.25 \text{ k}\Omega$.