Week 10 Quiz 3: BJT Design 2  
ECE 606: Solid State Devices  
Mark Lundstrom  
Purdue University, Spring 2013

Answer the **four multiple choice questions** below by choosing the **one, best answer**. Then ask a question about the lecture.

1) How does a poly-silicon emitter improve the performance of an NPN BJT?

   a) It increases current gain by suppressing recombination in the emitter-base junction.
   b) It increases current gain by suppressing the injection of holes from the base into the N-type emitter.
   c) It increases the Early voltage by effectively increasing the base doping.
   d) It suppresses the Kirk effect by effectively increasing the collector doping.
   e) It increases current gain by suppressing recombination in the quasi-neutral base.

2) As the base width shrinks, transport across the base becomes ballistic. Which of the following is true when base transport is nearly ballistic?

   a) \( D/W_B = v_{thermal} \)
   b) \( D/W_B \gg v_{thermal} \)
   c) \( D/W_B << v_{thermal} \)
   d) \( 2D/W_B^2 << v_{thermal} \)
   e) \( W_B^2/2D_n < v_{thermal} \)

3) The gain-bandwith product, \( \omega_T \), is the frequency at which the short-circuit current gain drops to 1. It is an important figure of merit that applies to any transistor. What is the expression for \( \omega_T \)?

   a) \( \omega_T = g_m \times \left(C_\pi + C_\mu \right) \)
   b) \( \omega_T = \left(C_\pi + C_\mu \right)/g_m \)
   c) \( \omega_T = g_m/\left(C_\pi + C_\mu \right) \).
   d) \( \omega_T = g_m/C_\pi \).
   e) \( \omega_T = g_m/C_\mu \).

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4) Which of the following is true of the breakdown voltage, $V_{BR}$, of the base-collector junction?

a) $V_{BR}$ for common emitter is about the same as $V_{BR}$ for common base.
b) $V_{BR}$ for common emitter is larger than $V_{BR}$ for common base.
c) $V_{BR}$ for common emitter is smaller than $V_{BR}$ for common base.
d) $V_{BR}$ for common emitter is larger than $V_{BR}$ for common base when Zener tunneling dominates.
e) $V_{BR}$ for common emitter is larger than $V_{BR}$ for common base when impact ionization dominates.

5) What question(s) do you have about this lecture?

Turn in to Ms. Wanda Dallinger, EE-326 by Friday, March 22