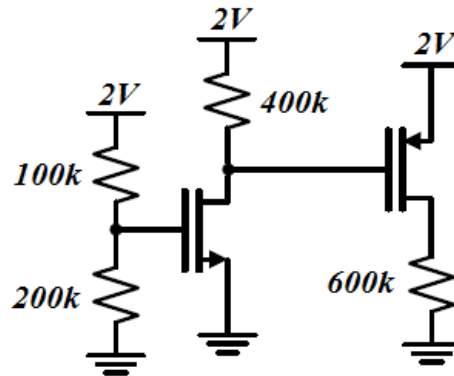
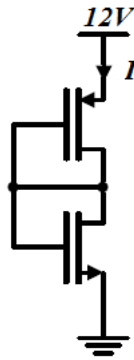


**The University of Michigan**  
**EECS 311: Electronic Circuits**  
**Fall 2009**  
**Review for Quiz #2**

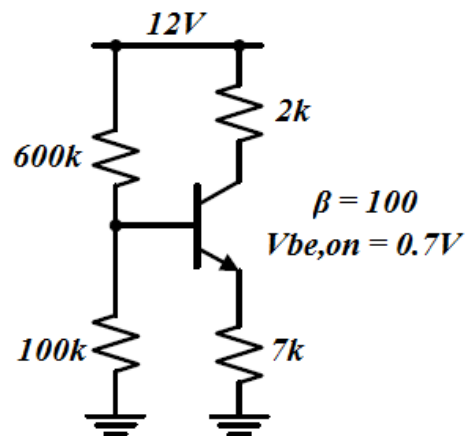
- R2.1** Draw the following representations for an NPN and a PNP transistor. Label all components and terminals:
- (a) Circuit symbol
  - (b) Transport model equivalent
  - (c) Large signal model (FAR, RAR, SAT, Cutoff)
  - (d) Small signal model
- R2.2** Find the Currents through the transistors in the circuit below.  $V_{tn} = 1V$ ,  $V_{tp} = -1V$ ,  $K_n = 60\mu A/V^2$ ,  $K_p = 40\mu A/V^2$ .



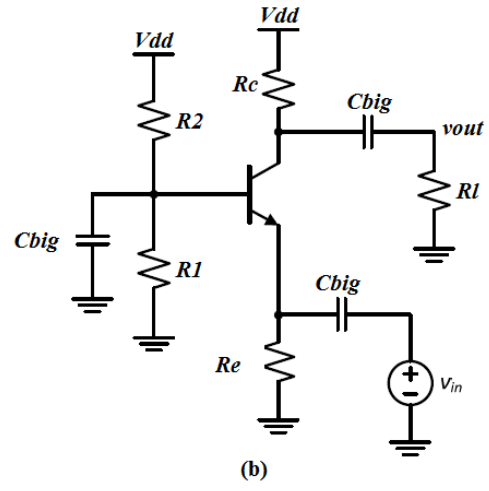
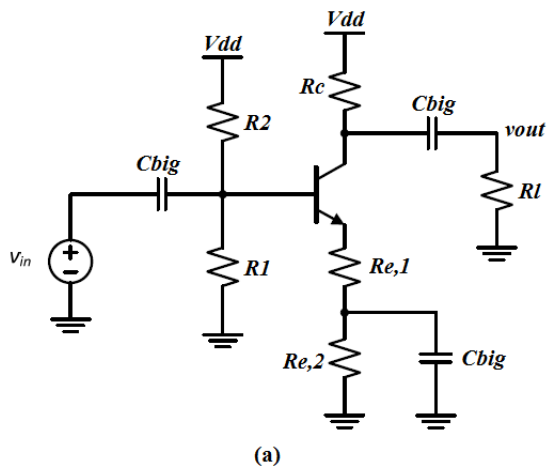
- R2.3** Find the current  $I$  in the circuit below.  $V_{tn} = 1V$ ,  $V_{tp} = -1V$ ,  $K_n = 60\mu A/V^2$ ,  $K_p = 40\mu A/V^2$ .



- R2.4** Find the percent error in  $I_c$  if  $\beta_F$  is increased by 10% in the circuit below with and without the emitter resistor.



**R2.5** Draw the small signal equivalent of the circuits below.



**R2.6** For circuit (b) above, derive the midband gain  $A_v = v_{out}/v_{in}$ ;