Written exam at courses – UNOFFICIAL TRANSLATION

ELEMENTI POLPREVODNIŠKE ELEKTRONIKE and ELEMENTS OF SEMICONDUCTOR ELECTRONICS

I. grade – 2. year – Electronics – AE

6. 9. 2013

1. Homogeneously doped silicon block of *p*-type with cross-sectional area of A = 0,1 cm^2 and length of L = 1 cm has resistance of R = 10 Ω. The mobility of the holes is 440 cm^2/Vs, electron' 1250 cm^2/Vs. Calculate the concentration of acceptor impurities. Calculate the difference between the Fermi level and the valence band edge $\Delta E = E_F - E_V$ at room temperature and sketch energy band diagram.

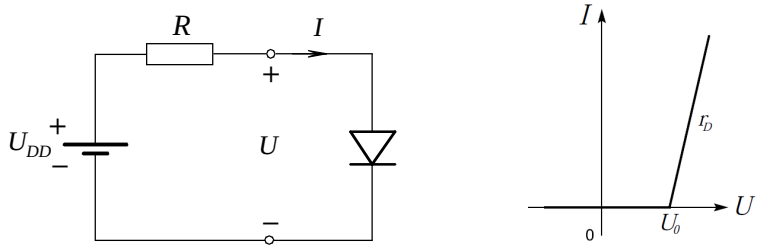
   E_G = 1,12 eV

   (Solution: **$N_A = 1{,}42\times10^{16}$ cm-3, E_{Fi}-E_V = 0,196 eV**)

2. In the given circuit calculate the value of the resistor R so that the current through the diode is I = 50 mA. Piecewise linear characteristic of the diode is given.

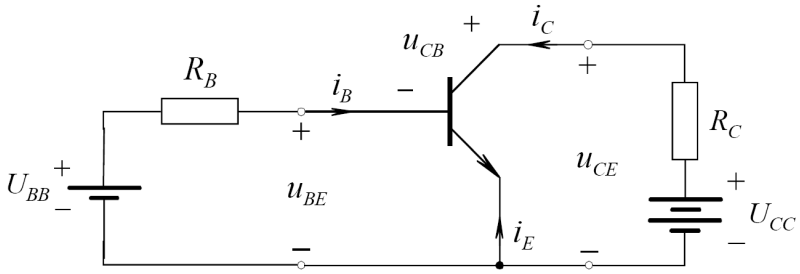
   U_0 = 0,6 V
   r_D = 12 Ω
   U_{DD} = 3,7 V

   (Solution: U = 1,2 V, **R = 50 Ω**)



3. Determine the type and orientation of the transistor and calculate the operating point and determine region of operation.

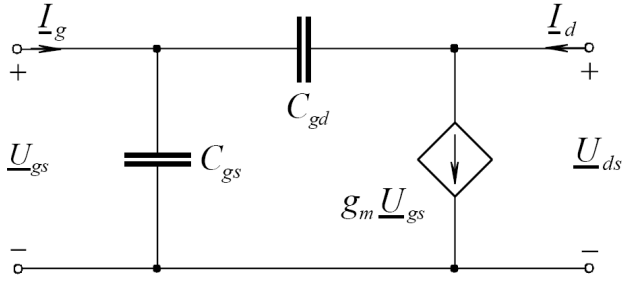
   U_{CC} = 12 V, R_C = 1 kΩ
   α_F = 0,99 α_R = 0,8
   U_T = 25,66 mV
   I_{CS} = 1,2 pA
   $-I_E$ = 4 mA



   (Solution: ***npn*, common emitter, active range, I_C = 3,96 mA, I_B = 40 µA, U_{CE} = 8,04 V, I_{ES} = 0,97 pA, U_{BE} = 0,568 V**)

4. Calculate admittance quadripole parameters $\underline{y}_{11}$ in $\underline{y}_{12}$ of the junction FET-a, which operates in the operating point with a U_{GS} = −2.0 V in the saturation range and is the controlled by small high-frequency signals with a frequency of f = 10 MHz, and can be replaced with a given replacement circuit.

   U_P = −4 V
   I_{DSS} = 16 mA
   C_{gs} = 10 pF
   C_{gd} = 2 pF



   (Solution: **$\underline{y}_{11}$ = j754 µS, $\underline{y}_{12}$ = j126 µS**)

You have 60 minutes, you are allowed to use a sheet with basic formulas and constants.
The results are expected to be published on Monday 9. 9. till 16 hours in the inf. system.