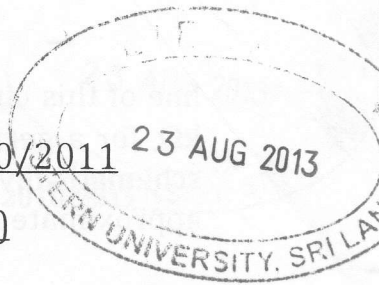


EASTERN UNIVERSITY, SRI LANKA

SECOND EXAMINATION IN SCIENCE - 2010/2011

FIRST SEMESTER (April/May 2013)

PH 202 ELECTRONICS I



Time: 01 hour.

Answer ALL Questions

- 1) (i) Distinguish an n-type extrinsic semiconductor from an intrinsic semiconductor. Outline the difference in charge carriers in the above two types of materials by means of valence-conduction energy band diagram.
- (ii) An approximate formula for intrinsic carrier concentration (cm^{-3}) of Si as a function of temperature is $n_i = 3.87 \times 10^{16} T^{3/2} e^{-7000/T}$. For an intrinsic Si specimen at 270 K, determine the percentage of Si atoms that contribute to the conduction of electron-hole pair. Hence determine the conductivity of the intrinsic Si specimen at temperature 270 K.
- (iii) An intrinsic Si specimen is doped with an appropriate donor element to the small concentration of one part per million Si atoms, determine the resulting conductivity for the n-type Si specimen. Compare with the value with that of pure Si specimen.

Take the mass density and atomic weight of Si to be 2.33g/cm^3 and 28.09 a.m.u. respectively; and the charge of an electron as $1.6 \times 10^{-19} \text{C}$. Also assume the mobility of electrons and holes at 270 K to be 1300 and 500 $\text{cm}^2/\text{V.s.}$ respectively. Also you may consider that the conductivity of a semiconductor is given by $\sigma = |q|(n\mu_e + p\mu_h)$; the symbols have their usual meaning. (1 a.m.u. = $1.66 \times 10^{-27} \text{kg}$).

- 2) Figure 1 shows a circuit diagram of a single-stage amplifier in common-emitter configuration. Describe briefly the meaning of leakage current in a transistor and discuss how it affects the collector current. Outline the purpose of the resistor R_E and capacitor C_E in the circuit shown in figure 1.

Use Thevenin's theorem and obtain an expression for the input voltage of the circuit shown in figure 1. Also obtain an expression for the dc load

line of this circuit. If $V_{CC}=20V$, $R_1=100\text{ k}\Omega$, $R_2=25\text{ k}\Omega$, $R_C=4\text{ k}\Omega$ and $R_E=6\text{ k}\Omega$, for a germanium transistor with $V_{BE}=0.3\text{ V}$ and dc-current gain 50, schematically plot the dc load line and Q-point for this circuit. You may approximate $I_C \approx I_E$.

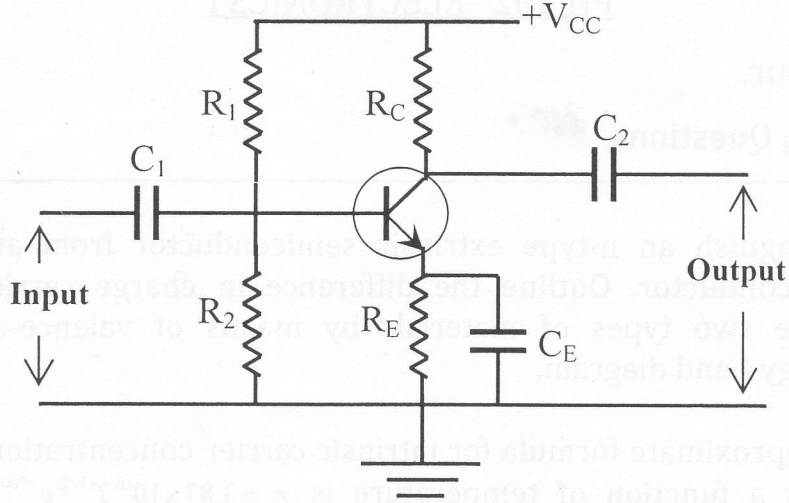


Figure 1