EASTERN UNIVERSITY, SRI LANKA

SECOND EXAMINATION IN SCIENCE – 2014/2015

FIRST SEMESTER (REPEAT)

(November 2016)

PH 202 ELECTRONICS - I

Time: 01 hour

Answer ALL Questions

Q1.

Distinguish a p-type extrinsic semiconductor from an intrinsic semiconductor in terms of charge carriers, explaining by use of valence–conduction energy band diagrams. ... (50% marks)

A relation for the intrinsic carrier concentration $n_i(cm^{-3})$ in silicon as a function of temperature $T(K)$ is given by

$$n_i(T) = 5.29 \times 10^{19} \, (T/300)^{2.54} \, exp^{(-6726/T)}$$

(i) Hence determine the resistivity of the intrinsic silicon specimen at 25 ^{0}C.

(ii) An intrinsic silicon specimen is doped with an indium atom to the small concentration of one part per 10 million silicon atoms; determine the resulting resistivity for the impure silicon specimen. Compare with the value that of pure silicon specimen.

... (50% marks)

You may assume that the resistivity of a semiconductor is given by $\rho = \frac{1}{(n\mu_e + p\mu_h)|q|}$; where the symbols have their usual meaning. Also assume the mobility of electrons and holes at 25^0 C to be 3800 and 1800 cm^2/Vs respectively. Also take the mass density and atomic weight of silicon to be 2.33 g/cm^3 and 28.09 a.m.u. respectively; and an electron charge as $1.6 \times 10^{-19}\, C$. $(1\, a.m.u. = 1.66 \times 10^{-27} kg)$

Q2.

Briefly explain the action of p-n-p bipolar junction transistor (BJT) in amplifying mode. ... (25% marks)

Describe by means of a schematic diagram the output characteristics of BJT, identifying the active, saturation and cut-off regions. Describe the function of the BJT in each of these regions. ... (25% marks)

The figure below shows the modified form of a simple common-emitter amplifier where the base bias is supplied from the collector.

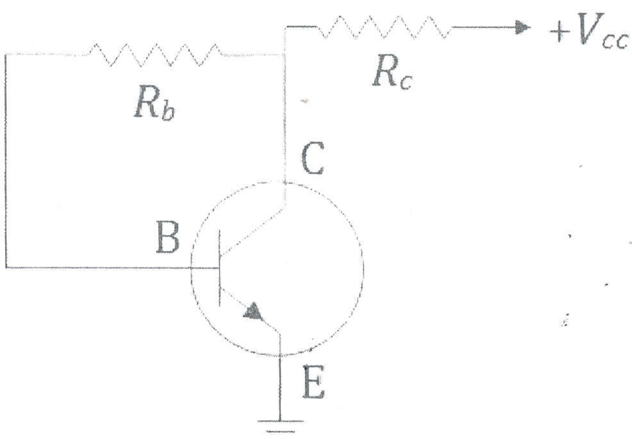

Figure 01

The d.c. power supply is V_{CC} = 12 V and for a germanium transistor ($V_{BE} = 0.3V$) of $\beta = 100$, the **operating point** is set at $V_{CE} = 8V$ and $I_C = \frac{1}{2} mA$; find the values of R_b and R_c. If another germanium transistor is now replaced with $\beta = 250$, find the new operating point.

... (50% Marks)