DR. BABASAHEB AMBEDKAR TECHNOLOGICAL UNIVERSITY, LONERE – RAIGAD -402 103

SOLUTION: Mid Semester Examination – Summer - 2018

Branch: Group A Sem.:- II

Subject with Subject Code:- Basic Electronics Engineering (EXE205) Marks: 20

Date:- 16/03/2018 Time:- 1 Hr.

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Q.1. Multiple choice questions (Solve any Six) 06

a) What is an energy gap?: **The energy equal to the energy acquired by an electron passing a 1 V electric field**
b) In "n" type material, majority carriers would be: **Electrons**
c) A commonly used pentavalent material is: **Arsenic**
d) Forward bias of a silicon P-N junction will produce a barrier voltage of approximately how many volts?: **0.7**
e) When is a P-N junction formed?: **the point at which two opposite doped materials come together**
f) The reverse current in a diode is of the order of **μA**

Q.2. Attempt any one of the followings:

a) A simple n-type silicon has a donor density of $10^{29}/m^3$. It is used in the hall effect experiment. If the sample of width 4.54 mm is kept in a magnetic field of 0.55T with current density of $500 A/m^2$. Calculate: 06
   a) The Hall voltage developed into it.
   b) The Hall Coefficient and
   c) The Hall angle if mobility of electron is $0.17 m^2/V$ sec.

Solution:

Given donor density $N_D = 10^{20}/m^3$; Width (w) = 4.5 mm=4.5×10^{-3} m; Magnetic field of (B)= 0.55T

Current density (J) = 500 A/m^2;mobility of electron (μ_e) = 0.17 m^2/V sec.

Hall Voltage: $V_H = \frac{J\,B\,w}{n\,e}$

$$\text{Put } n = N_D = \frac{J\,B\,w}{N_D\,e} = \frac{500 \times 0.55 \times 4.5 \times 10^{-3}}{10^{20} \times 1.6 \times 10^{-19}}$$

V_H = 0.0773 volt = 77.3 ×10^{-3} volt **(02 Marks)**

Hall coefficient (R_H)

$$R_H = \frac{1}{n\,e} = \frac{1}{N_D e} = \frac{1}{10^{20} \times 1.6\times10^{-19}} = \mathbf{R_H = 0.0625\ m^3/C}$$ **(02 Marks)**

Hall angle **tan** $\theta = \mu_e B = 0.17 \times 0.55 =$ **0.0935**

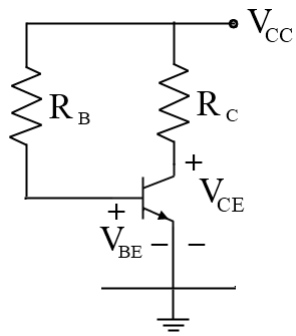
$\theta = 5.34^0$ (02 marks)

Note: Marks is to be given only if formula and calculations are written correctly. No separate marks need to be given to either only formula or direct solutions.

b) Design a fixed bias circuit using silicon transistor having h_{FE} = 100, V_{CC} =12V and DC bias conditions are V_{CE} = 6V, I_C = 3mA and V_{BE} = 07 V. 06

Solution:

Circuit Diagram: **(01 mark)**



$$V_{CE} = V_{CC} - I_C R_C$$

$$R_C = \frac{V_{CC} - V_{CE}}{I_C} = \frac{12-6}{3\times10^{-3}}$$

$R_C = 2\ K\Omega$ **(02 mark)**

Now, $\therefore\ I_C = \beta I_B$

$$\therefore\ I_B = \frac{I_C}{\beta} = \frac{3mA}{100} = 30\mu A \textbf{ (01 mark)}$$

$$\because\ I_B = \frac{V_{CC} - V_{BE}}{R_B}$$

$$\therefore R_B = \frac{12-0.7}{30\times10^{-6}} = 376.67\ K\Omega \textbf{ (02 mark)}$$

Note: Marks is to be given only if formula and calculations are written correctly. No separate marks need to be given to either only formula or direct solutions.

Q.3. Attempt any two of the followings:

a) Define α, β for a transistor. Derive the relationship between α and β. 04

Marking Scheme:

- Definition of α and β: 01 mark each
- Derivation of the relationship between α and β=02 marks.

b) Explain with neat diagram and waveforms, the working of a diode as a switch. 04

Marking Scheme:

- Circuit diagram:01 mark
- Input and output waveforms:01 mark
- Exaplanation:02 mark

Note: Marks shall be awarded as above only when the entire answer is

<u>in order. No stepwise marks need to be given.</u>

c) Define valance electrons. Explain how they help in bonding of solids. 04

Marking Scheme:

- Definition of Valance electron:**01 mark**
- Explanation of role valance electrons i.e. their positional befit in bonding and their availability for bonding: **03 marks**

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