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TEC–101

B. TECH. (FIRST SEMESTER)

MID SEMESTER EXAMINATION, NOV., 2021

(All Branches)

BASIC ELECTRONICS ENGINEERING

Time : 1½ Hours

Maximum Marks : 50

Note : (i) Answer all the questions by choosing any ***one*** of the sub-questions.

(ii) Each question carries 10 marks.

1. (a) Explain formation of energy bands in a solid crystal. Differentiate conductor, semiconductor and insulator based on energy band diagram. Calculate the drift current produced in a intrinsic Ge semiconductor having area of cross-section 2 cm^2 and length 0.4 mm, if concentration of free electron is $2 \times 10^{19}/m^3$ a battery of 2 volts is applied across its length. Given that mobility of free electrons and holes is 0.36 m^2/V-sec and 0.17 m^2/V-sec respectively. 10 Marks (CO2)

OR

(b) Briefly explain drift current and diffusion current in semiconductors. An intrinsic semiconductor (Si) is doped with a donor type impurity such that there is one impurity atom on 10^6 atoms of semiconductor.

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The total concentration of semiconductor is $5 \times 10^{22}/m^3$ and intrinsic concentration is $2.5 \times 10^{12}/m^3$.

Calculate : 10 Marks (CO2)

(i) Resulting donor atom concentration.

(ii) Resulting electron concentration.

(iii) Resulting hole concentration.

(iv) Conductivity of the doped sample if mobility of electrons is 3800 m^2/V-s.

2. (a) If N_D and N_A are donor and acceptor impurities and n_i is the intrinsic concentration, establish the relation for minority and majority charge densities in extrinsic semiconductors.

A small concentration of minority carries is injected into a homogeneous semiconductor crystal at one point. An electric field of 10 V/cm is applied across the crystal and this moves the minority carries a distance of 1 cm in 20 μ/sec. Determine mobility (in cm^2/V-sec).

10 Marks (CO2)

OR

(b) Define mobility and drift velocity. Prove that conductivity of a conductor is given by $\alpha = \mu ne$.

A bar of pure silicon has cross-sectional area of 1 mm^2 and intrinsic concentration of silicon is 1.5×10^{16} m^{-3}. The free electron and hole mobilities are 0.13 m^2/V-sec and 0.05 m^2/V-sec respectively. Find the conductivity and length of bar whose resistance is 50 kΩ.

10 Marks (CO2)

3. (a) $(7653.21)_8 = (?)_2 = (?)_{16} = (?)_{10}$ 10 Marks (CO1)

$(56543)_7 + (53214)_7 - (3264)_8 = (?)_7$

If $(211)_x = (152)_8$, find the value of base x.

If $(315)_x + (276)_x - (215)_x = (276)_x$, find the value of base x.

OR

(b) Express F (A, B, C, D) = (A′C) + (ABC′) + (A′C′D) + (ABD′) in canonical SOP and canonical POS form. Simplify the following functions using Boolean rules : 10 Marks (CO1)

$$\overline{A + \bar{A}B + \bar{A}\bar{B}} + \overline{A + \bar{B}}$$

$$F = (A + C)(AD + AD) + AC + C$$

$$A + AB + AB'C$$

4. (a) Subtract $(7476.23)_9 - (783.5)_9$ by r's complement method.

Subtract $(FBD9.E3)_{16} - (A2C.A)_{16}$ by $(r - 1)$'s complement method.

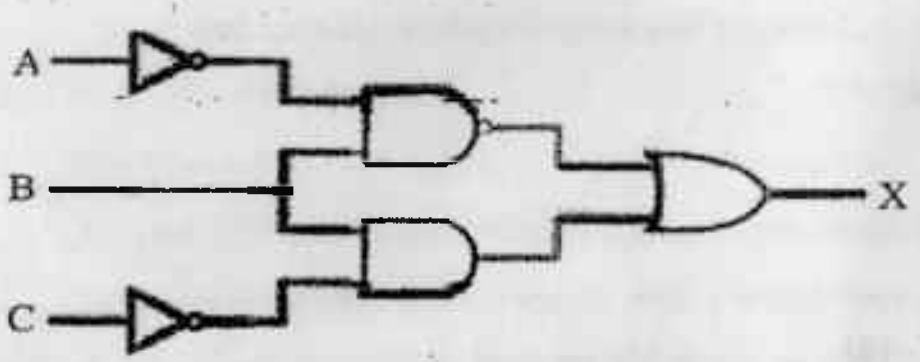
$(111.101)_2 \times (111)_2 = (?)_2$

$(111101)_2 / (101)_2 = (?)_2$ 10 Marks (CO1)

OR

(b) Realize EX-NOR gate by NOR gate only.

Derive Boolean expression for output X for given digital circuit and sketch truth table : 10 Marks (CO1)



5. (a) Minimize the following by K-map and realize the minimized function by (i) Basic gates, (ii) NAND gate only and (iii) NOR gate only :

10 Marks (CO1)

$$F(A, B, C, D) = \Pi M(0, 1, 3, 5, 7, 8, 9, 11, 13, 14, 15)$$

OR

(b) For the given truth table, express output Y in minimized SOP and minimized POS form : 10 Marks (CO1)

A	B	C	Y
0	0	0	0
0	0	1	0
0	1	0	0
0	1	1	1
1	0	0	1
1	0	1	0
1	1	0	0
1	1	1	1