Roll No. .....

TEC–101

B. TECH. (FIRST SEMESTER)

END SEMESTER EXAMINATION, Jan., 2023

(All Branches)

BASIC ELECTRONICS ENGINEERING

Time : Three Hours

Maximum Marks : 100

Note : (i) All questions are compulsory.

(ii) Answer any *two* sub-questions among (a), (b) and (c) in each main question.

(iii) Total marks in each main question are **twenty**.

(iv) Each sub-question carries 10 marks.

1. (a) If $(73)_x = (54)_y$ and $(54)_x = (40)_y$, find the value of x and y. (CO1)

(b) Solve the following equation with the help of K-map and implement it with NOR gate only : (CO1)

$$F(A, B, C, D) = \Sigma m(2, 3, 6, 7, 8, 10, 13, 14, 15) + \Sigma d(0, 1, 5, 12)$$

(c) State and prove De Morgan's theorem. Explain min-terms and max-terms. (CO1)

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2. (a) (i) What is energy band diagram ? Explain classification of materials on the basis of energy bank diagram.

(ii) A Si diode has reverse saturation current of 5 μA at 300 K. Find forward voltage to achieve a forward current of 1 mA. (CO2)

(b) With the help of a circuit diagram and suitable graph, explain forward bias *p-n* junction diode. Differentiate between Avalanche breakdown and Zener breakdown. (CO2)

(c) In a germanium sample, a acceptor type impurity is added to the extent of 1 atom per 10^8 Germanium. The density of Ge atoms is $4.41 \times 10^{22}/cm^3$. Find the electron and hole concentration in the doped semiconductor and calculate the conductivity of germanium as well. Given : (CO2)

$\mu_n = 3800\,cm^2/V\text{-}sec$

$\mu_p = 1800\,cm^2/V\text{-}sec$

$n_i = 2.5 \times 10^{13}/cm^3$

3. (a) Explain the working of half wave rectifier with capacitor filter and draw appropriate circuit diagram as well as input/output waveforms. Also, derive the average and r.m.s. current for half wave rectifier without filter. (CO3)

(b) (i) Explain the working of Zener diode as voltage regulator.

(ii) Define different types of filters. (CO3)

(c) A full-wave rectifier uses two diodes, the internal resistance of each diode may be assumed constant at 20 Ω. The transformer r.m.s. secondary voltage from centre tap to each of secondary is 50 V and load resistance is 980 Ω. Calculate the following : (CO3)

(i) I_m, I_{dc}, I_{rms}

(ii) a.c. power input

(iii) d.c. power input

(iv) d.c. output voltage

(v) efficiency of rectification

4. (a) (i) Derive the relationship between α, β and γ.

(ii) In a transistor if $\alpha = 0.995$ and Emitter current is 10 mA, I_{CBO} is 0.5 μA. Then determine I_C, I_B, β and I_{CEO}. (CO4)

(b) Explain the common collector configuration in detail. (CO4)

(c) Draw the common base configuration circuit and explain its current gain, input and output characteristics. (CO4)

5. (a) Derive an expression for output voltage of difference amplifier. (CO5/CO6)

(b) Derive an expression for output voltage of inverting and non-inverting op-amp. (CO5/CO6)

(c) Derive an expression for output voltage of summing amplifier. Also design an adder circuit using op-amp. to get $V_o = -(V_1 + 10\,V_2 + 100\,V_3)$; if $R_F = 100\,k\Omega$. (CO5/CO6)