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**Roll No. ....**

**TEC-201**

**B. TECH. (SECOND SEMESTER)  
END SEMESTER EXAMINATION,  
June, 2023**

**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) (i) Realize OR, NOT, AND gates using NOR gates only.
- (ii) Realize EX-OR and EX-NOR gates using NAND gates only. (CO1)

**P. T. O.**

(b) Prove the following using laws of Boolean Algebra : (CO1)

(i)  $AB + A'C + BC = AB + A'C$

(ii)  $(A' B' + AB)' = A' B + AB'$

(iii)  $AC + ABC' = AC + AB$

(c) (i) Perform  $(22)_{10} - (14)_{10}$  in binary using 1's complement.

(ii) Perform  $(15)_{10} \times (7)_{10}$  in binary

(iii) Simplify the following Boolean function using the K- map :

$$f(A, B, C, D) = \sum m(0, 2, 3, 8, 9, 10, 11, 12, 13, 14, 15) \quad (\text{CO1})$$

2. (a) Distinguish between insulators, semiconductors, and conductors on the basis of energy band theory. (CO2)

(b) (i) How is a semiconductor electrically neutral ? Define the intrinsic carrier concentration of a semiconductor.

(ii) Discuss the breakdown mechanism of a PN junction diode. (CO2)

(c) (i) A donor impurity concentration of  $8 \times 10^{14} / \text{m}^3$  is added to a pure silicon

semiconductor material. The intrinsic carrier concentration is  $10^{10} / \text{m}^3$ . Determine the concentration of majority and minority carriers. (CO2)

- (ii) Determine the value of forward voltage across a p-n junction diode if a 3 mA of forward current is flowing through it at room temperature. Assume, the value of reverse saturation current is  $1.5 \mu\text{A}$  and the ideality factor of diode is 1. (CO2)

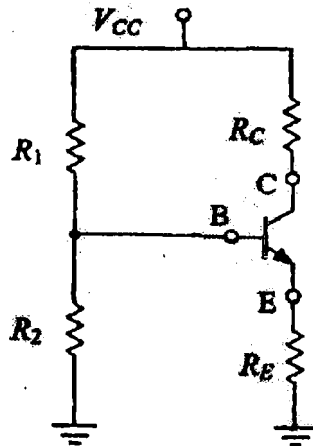
3. (a) Discuss the working of a Bridge rectifier. Determine the value of ripple factor and maximum rectification efficiency for it.

(CO3)

- (b) Consider a half wave rectifier with ac supply voltage  $v(t) = 50 \sin(314 t)$ . The step down transformer has a turn ratio of 5 : 1. Assuming the forward resistance of diode to be 20 ohms and load resistance of 5 kilo ohms, determine the dc voltage and dc power developed at the load. Also find out the rectification efficiency of this rectifier. (CO3)

**P. T. O.**

- (c) Draw a neat circuit diagram of Zener diode based voltage regulator circuit. Discuss its working. (CO3)
4. (a) Draw the circuits for CB, CE, and CC configurations of BJT. Also draw the input and output characteristics of CE configuration. (CO4)
- (b) What do you mean by leakage currents  $I_{CBO}$  and  $I_{CEO}$  of BJT. Derive a mathematical relation between them. (CO4)
- (c) For the following circuit, determine the collector current  $I_C$  and collector to emitter voltage  $V_{CE}$ . Given,  $R_1 = 100\text{ k}\Omega$ ,  $R_2 = 5\text{ k}\Omega$ ,  $R_C = 2\text{ k}\Omega$ ,  $R_E = 100\text{ }\Omega$ ,  $V_{BE} = 0.3\text{ V}$ ,  $\beta = 50$  and  $V_{CC} = 20\text{ V}$ .



5. (a) Draw and explain the pin diagram of 741 IC of Op-amp; Write the characteristics of an ideal OP-AMP. (CO5)
- (b) Draw the following OP-AMP based circuits and derive the expressions of output for both : (CO5)
- (i) Non-inverting amplifier
- (ii) Differentiator
- (c) Determine output voltage  $V_o$  in following circuit : (CO5)
- Given  $V_1 = 8\text{ V}$  and  $V_2 = 15\text{ V}$

