Ref. No. Ex/ME(M2)/ES/B/ET/T/113/2024

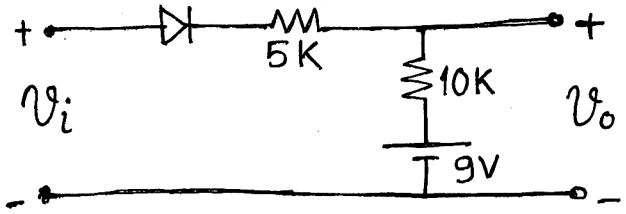
B.E. MECHANICAL ENGINEERING FIRST YEAR FIRST SEMESTER - 2024

ELECTRONICS

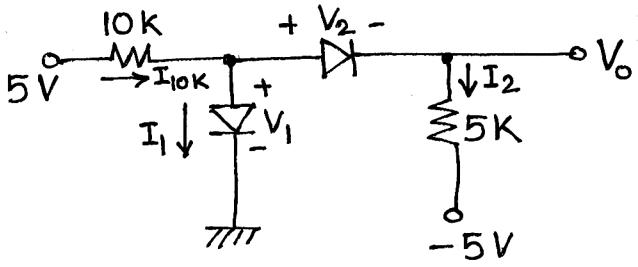
Time : 3 hrs **Full Marks: 100**

GROUP - A
Answer any three questions.

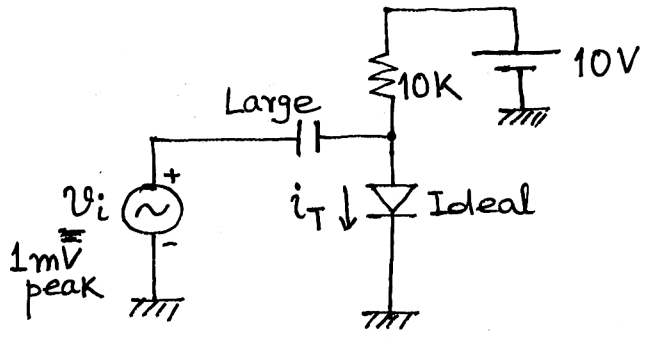
1. a) Plot v_0 versus v_i for the following circuit assuming the diode to be ideal. 10



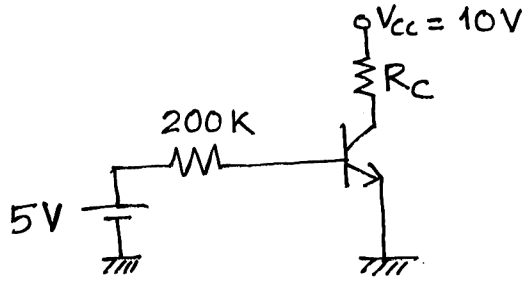
b) Find the marked voltages and currents in the following circuit assuming diodes to be ideal. 10



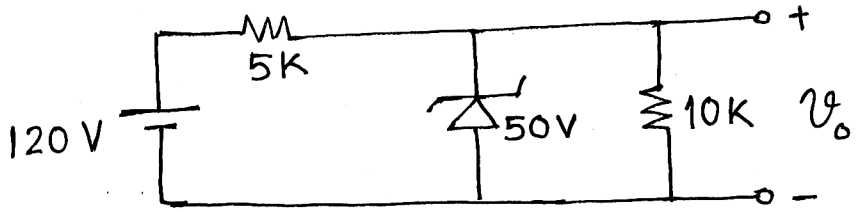
2. a) Find the total current i_T through the diode in the following circuit. 10



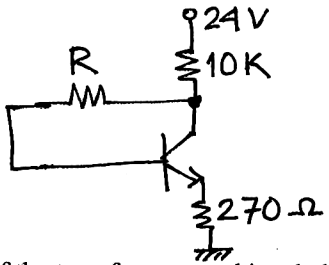
b) For the transistor in the following figure, $\beta = 100$, the values of V_{BE} and V_{CE} at saturation are 0.8V and 0.2V respectively. What is the minimum value of R_C for which the transistor remains in saturation? 10



3. a) For the circuit shown, find the output voltage, the voltage drop across the series resistance and the current through the zener diode. 10



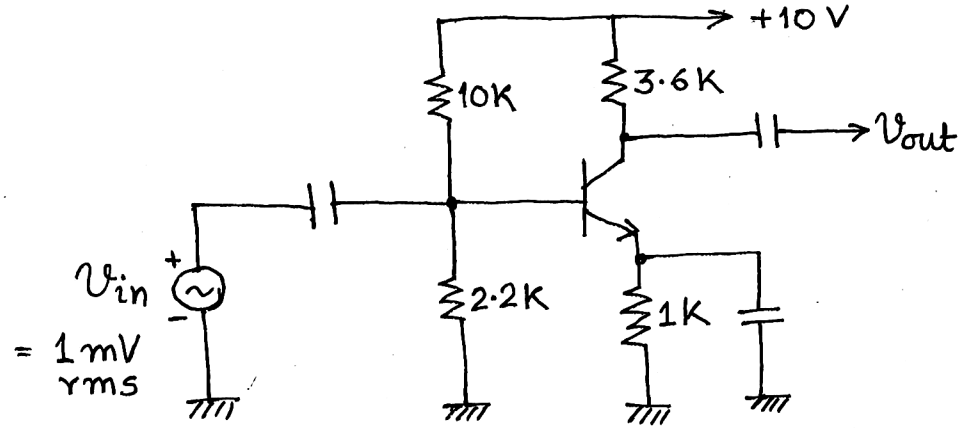
b) The silicon transistor in the following circuit is used with $\beta = 45$ and if $V_{CE} = 5$ V, find R. 10



4. a) The turns ratio of the transformer used in a half-wave rectifier is N1:N2 = 12:1 . The primary is connected to 220V, 50Hz power mains. If the diode voltage drop is zero, find the dc voltage across the load. What is the PIV of the diode? 10

b) An op-amp inverting amplifier has an input resistor of 10 kΩ and a feedback resistor of 50 kΩ. If the input voltage is 0.5 V, find the output voltage and the input current. Deduce the formula that you have used. 10

5. a) For the following circuit assume that the transistor has a large β and $V_{BE} = 0.7$ V. Find (i) the voltage gain from the base to the output, (ii) The output voltage for an input voltage of 1mV rms. 12



b) Draw the block diagram of a simplified digital thermometer and explain the function of individual blocks. 8

GROUP - B
Answer any two questions.

6. a) Obtain the truth table for the following function: $f = AB + A\overline{B} + \overline{B}C$ 6

b) Implement the following logic function using MOS transistors: $f = A(B+C)$ 6

c) Implement the following Boolean function using (i) only NAND gates and (ii) only NOR gates: $f = AB + C$ 8

7. a) Express the following function in minterm and maxterm forms. 10

$$f(A,B,C) = (\overline{A} + B)(\overline{B} + C)$$

b) Simplify the following Boolean function using K-map. 10

$$f(A,B,C,D)=\Sigma(0,\ 1,\ 2,4,\ 5,6,8,9,12,13,14)$$

8. a) Write the truth table of a full adder; obtain the relevant logic functions and hence implement it using two half adder blocks and one extra gate. 10

b) Draw the block diagram of 2x1 MUX; Explain its operation and implement it using logic gates. Explain the operation of a decoder also. 10