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Brac University

Set: 01

Semester: Spring 2022

Course No: CSE251

Course Title: Electronic Devices and Circuits

Section: 1 to 14

Final

Full Marks: 40

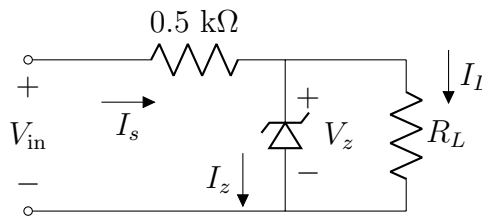
Time: 2 hours

Date: May 13, 2022

Answer all 4 questions. All the questions carry equal marks.

Question 1 [CO1, CO2]

10



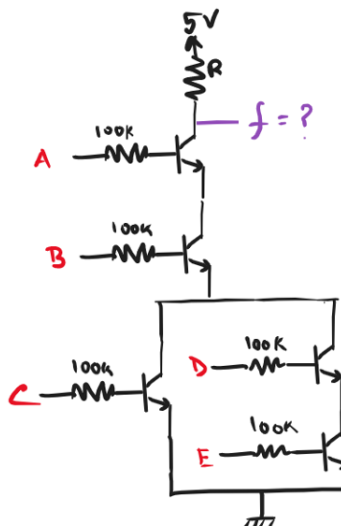
In the circuit, the input voltage V_{in} has a nominal voltage of 10 V with a fluctuation of $\pm 10\%$. The Zener diode in the circuit is specified with parameter $V_z = 5.75$ V at $I_z = 5$ mA, $r_z = 0.05$ k Ω , and $I_{zk} = 0.3$ mA.

- Compute** the Zener diode parameter V_{z0} . [2]
- Identify** the worst-case conditions and **calculate** the Zener current (I_z), Zener voltage (V_z), and the input voltage in this worst-case scenario. [1+1+1+1]
- Calculate** the source current I_s and the load current I_L in the worst-case conditions. [2]
- Design** the circuit, i.e., find the value of R_L , such that even in the worst-case scenario voltage regulation is maintained. [2]

Question 2 [CO3, CO4]

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- Analyze** the circuit below to find an expression of f in terms of *boolean* inputs A , B , C , D , and E . [3]



Set: 1

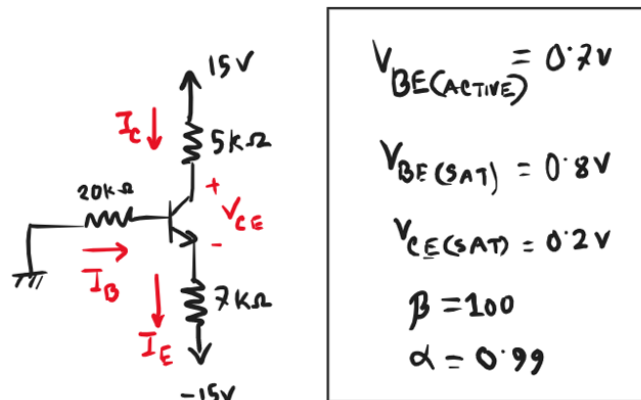
- (b) **Design** a circuit using ideal MOSFETs (S-model) to implement the logic function $f = \overline{AC} + \overline{(B + D)}$ [2]
- (c) **Show** (draw) and **label** the circuit diagram of a MOSFET common-source small-signal amplifier. **Describe** its operation in short in the saturation region. [2+2]

Question 3 [CO1, CO4]

10

Analyze the following circuit to find the values of I_D and V_{DS} . Here, **use** the Method of Assumed State. You must **validate** your assumptions.

[7 + 3]



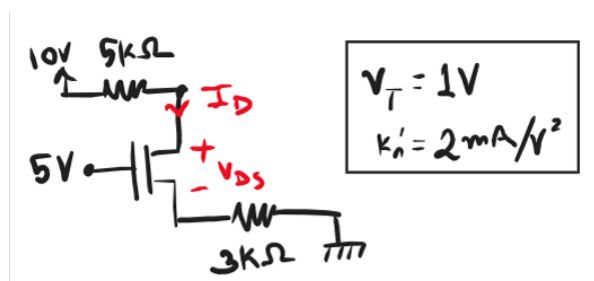
Question 4 [CO1, CO4]

10

Analyze the following circuit to find the values of I_D and V_{DS} **using** the Method of Assumed State. You must **validate** your assumptions.

[7 + 3]

Hint: Use I_D as unknown x . Use Ohm's law to represent V_D and V_S in terms of x .



For MOSFET

$$I_D = 0, \text{ if } V_{GS} < V_T$$

$$I_D = k'_n \left[(V_{GS} - V_T) V_{DS} - \frac{1}{2} V_{DS}^2 \right], \text{ if } V_{GS} \geq V_T \text{ and } V_{DS} < (V_{GS} - V_T)$$

$$I_D = \frac{1}{2} k'_n (V_{GS} - V_T)^2, \text{ if } V_{GS} \geq V_T \text{ and } V_{DS} \geq (V_{GS} - V_T)$$