Roll No.: .....

National Institute of Technology, Delhi

Name of the Examination: B. Tech

Branch	: ~~ECE~~ & EEE & CSE	**Semester**	: III
Title of the Course	: Analog Electronics	**Course Code**	: ECB 206

Time: 3 Hours **Maximum Marks: 50**

Note:

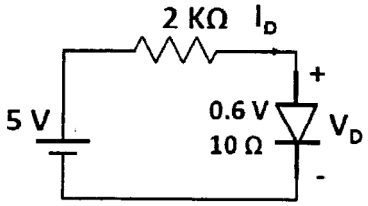
- Answers should be CLEAR, TO THE POINT AND LEGIBLE.
- All parts of a single question must be answered together. ELSE QUESTION SHALL NOT BE EVALUATED.
- All questions in Section A are compulsory. Attempt any 4 questions from Section B and 2 questions from Section C.

Section A

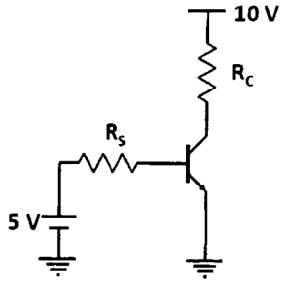
Q 1 Solve the following problems (2×5)

a. What is Zener diode? Explain, how it works as voltage regulator with the help of its VI-characteristics.

b. Calculate I_D and V_D in the circuit shown below.



c. A silicon transistor with $V_{BE,sat}$ = 0.8 V, β = 100, $V_{CE,sat}$ = 0.2 V and R_S = 200 KΩ is used in the circuit shown below. Find the minimum value of R_C for which the transistor will remain in the saturation.

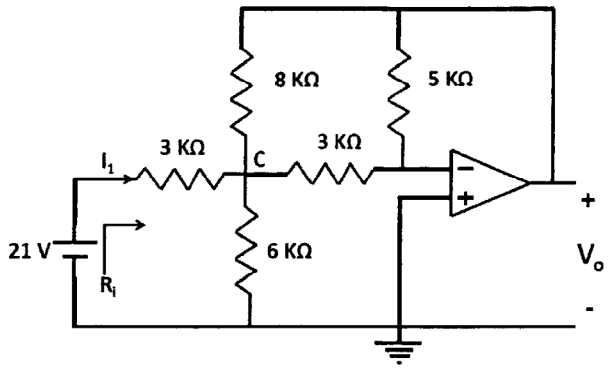


d. Determine the output voltage of an op-amp for the input voltages of 150 μV and 140 μV, if the differential gain is 4000 and value of CMRR is 10^5.

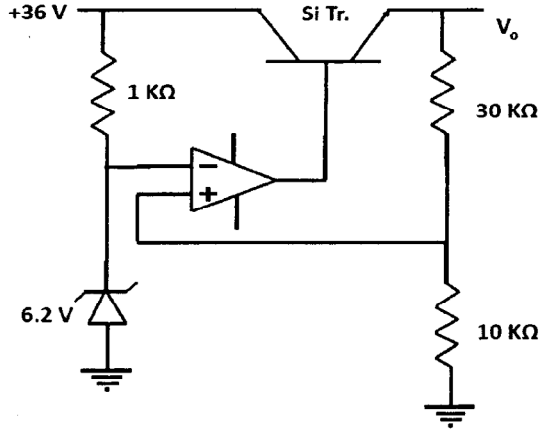
e. Sketch the circuit diagrams of the voltage series and shunt feedback amplifiers by using op-amp and potential divider network.

Section B

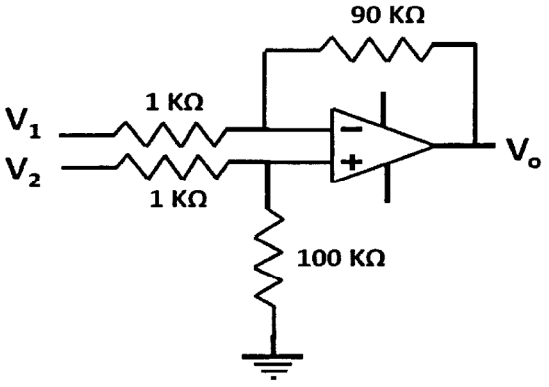
Q 2 Find, I_1, R_i, V_c and V_o for circuit shown below. **(5)**



Q 3 (a) Find the output V_o for the series regulator circuit shown below. **(2.5)**



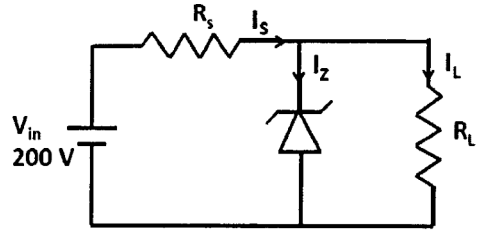
(b) Find differential gain, common mode gain and CMRR of the OPAMP circuit shown below. **(2.5)**



Q 4 A 50 V, 5 to 40 mA is used as shown in the regulator circuit- **(2.5+2.5)**

(a) Calculate R_s to allow voltage regulation from I_L = 0 to I_{Lmax}. Also calculate I_{Lmax} value?

(b) If R_s is set as found in part (a) and I_L is fixed at 25 mA, then what is the permissible range of V_{in}, for Zener diode to act as regulator safely?

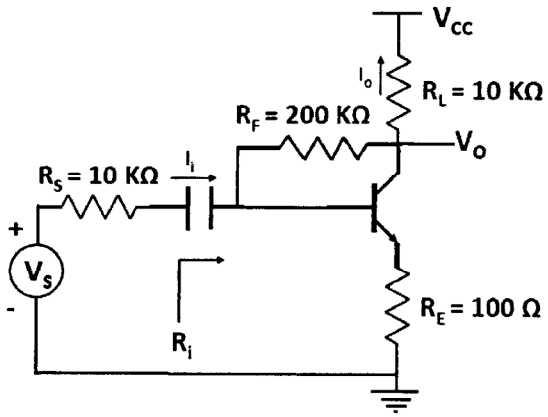


Q 5 Assume that a Si transistor with $\beta = 50$, $V_{BE,active} = 0.7$ V is biased using potential divider network with $V_{CC} = 22.5$ V and collector resistance $R_c = 5.6$ KΩ. It is desired to establish a Q point at $V_{CE} = 12$ V, $I_C = 1.5$ mA, and stability factor $S \leq 3$. Find the emitter resistance R_e, resistance connected between the base and supply (R_1) and resistance connected between the base and ground (R_2). **(5)**

Q 6 Why do you need constant current biasing in the differential amplifier? Draw the circuit diagram of a differential amplifier using current mirror circuit and briefly discuss about the functioning of the circuit. **(5)**

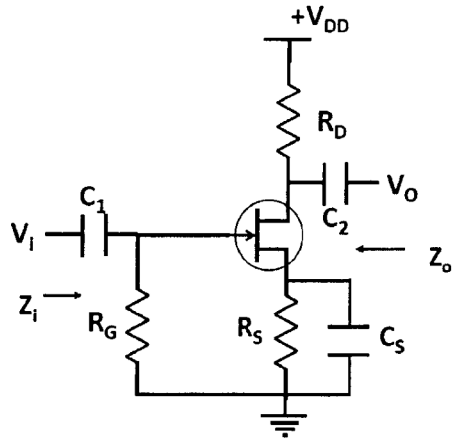
Section C

Q 7 For the circuit shown below, calculate $A_I = I_o/I_i$, A_V, A_{Vs}, and R_i. Assume suitable *h*-parameters. **(10)**



Q 8 Draw the schematic diagram of Enhancement mode MOSFET. Explain its working principle along with drain characteristics and transfer characteristics curves. **(10)**

Q 9 For the FET amplifier shown in the circuit, calculate input impedance (Z_i), output impedance (Z_o) and voltage gain (A_v) with and without bypass capacitor (C_s). **(10)**



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