Roll No.:.....

National Institute of Technology, Delhi

Name of the Examination: B. Tech ECE 2nd Year Spring Semester 2022

Branch	: ECE	Semester	: IV
Title of the Course	: ANALOG ELECTRONICS	Course Code	:ECB 252

Time: 3Hours Maximum Marks: 50

- **Answers should be CLEAR ANDTO THE POINT. All parts of a single question must be answered together. ELSE, QUESTION SHALL NOT BE EVALUATED.**

1.	For the circuit shown in **figure 1**, the measurement indicates that V_B = -1.5V. Assuming V_{BE}=0.7V, **(a)** Calculate voltage at the E-point, V_E, the voltage at the C point, V_C, and gain of the transistor, α and β. **(b)** If a transistor with β = α is now used; what values of V_E, V_B, V_C will result now? **(c)** What is the region of operation for the transistor in part (a)?	[5]
2.	Consider the second collector to first emitter feedback pair configuration in **figure 2**, For the amplifier configuration, Calculate, **(a)** Voltage gain of the first transistor, A_{v1}. **(b)** Voltage gain of the second transistor, A_{v2}. **(c)** Voltage gain of the two stages in cascade, A_v **(d)** The feedback factor of the network, β. **(e)** Overall voltage gain with feedback, A_{vf}. **(f)** Output resistance without feedback, R_o. **(g)** Output resistance with feedback R_{of}. **(h)** Input resistance with feedback R_{if}. Assume, R_s= 0, h_{fe}=50, h_{ie}=1.1K, h_{re}=h_{oe}=0 and all transistors are identical.	[8]
3.	Design an analog computer working based on the following differential equation: $4\frac{d^2y}{dt^2} + 9\int y.dt = V_o$. **(a)** Implement the individual terms of the above differential equation with minimum number of OP-AMPS to design the overall analog computer. **(b)** Then at the end summing different OP-AMPS blocks (i.e. adding OP-AMP circuitry implementing part, please draw the complete circuitry to implement the complete differential equation. Given that, y is only the primary inputs available.	[5]
4.	For the circuit given in **figure 3**, $V_1 = 10\sin 200t$ and $V_2 = 15\sin 200t$. What will be the output Voltage (V_{out})? Assume the OPAMP is an ideal one with infinite gain.	[5]
5.	Calculate output voltages and current V_o and i_o of the circuit shown in **figure 4**. What kind of feedback (positive/negative) amplifier will it be?	[3]
6.	For the following circuit in **figure 5**, determine voltages at the C and B points, i.e. V_C and V_B	[3]
7.	For the self-bias circuit as shown in **figure 6** the Q-point is assumed to be exactly at the middle of DC-Load line. What will be the expression for the total combination of R_c and R_e in terms of V_{CC} and power dissipation (P_{DQ}) at Q-point?	[2]

8.	An emitter-follower amplifier is shown in the **figure 7**. Z_i is the impedance looking into the base of the transistor and Z_o is the impedance looking into the emitter of the transistor. **(a)** Draw the small signal equivalent circuit of the amplifier. **(b)** Obtain an expression for Z_o. **(c)** Obtain an expression for Z_i **(d)** Determine Z_i and Z_o if a capacitor C_L is connected across R_L.	**[6]**
9.	**Write true (T)/ false (F) against each statement.**	**[10x0.5]**
(a)	Compensation circuits refer to resistive biasing circuits.	
(b)	Negative feedback is more suitable for amplification.	
(c)	Tentatively Q-point for a self-bias circuit will be at the middle of the load line.	
(d)	Q-point should be fixed with $V_{CEQ}<V_{CC}/2$ in order to avoid thermal runaway.	
(e)	The term low frequency implies the range of frequencies of the input signal in which effects of internal capacitances are considered.	
(f)	CC amplifier provides current gain instead of voltage gain.	
(g)	A CE transistor stage connected in series with a CB transistor stage provides the cascade combination.	
(h)	Difference amplifier is used to amplify the difference between two signals.	
(i)	At α-cut off frequency, the high-frequency α falls to 0.707 α_0.	
(j)	At high-frequency operation, h-parameters are real numbers.	
10.	**Opt for the correct option and write down the correct answer in the answer sheet only.**	**[8x1]**
(a)	In a self-bias circuit, the stability increases, as the base resistance **increases/decreases/ remains constant.**	
(b)	An amplifier supplies output current proportional to the signal voltage and independent of R_S and R_L known as- **trans-resistance/trans-conductance/current amplifier**.	
(c)	The physical model of transistor includes **early feedback generator/base spreading resistance /both.**	
(d)	Operation of feedback network is **unidirectional/bi-directional/omni-directional.**	
(e)	For an oscillator, the source of electrical input is **D.C. supply/ac source/generated noise**.	
(f)	From a circuit design point of view, more practical parameter to measure **transistor gain/transistor gain with feedback/transistor gain with feedback** and including source.	
(g)	To increase the stability in an amplifier circuitry against noise, a **positive feedback/ negative feedback/ oscillator circuit** is used.	
(h)	In a physical model of a transistor, a circuit early feedback generator is used to represent the **early effect/ thermal runaway/ both.**	

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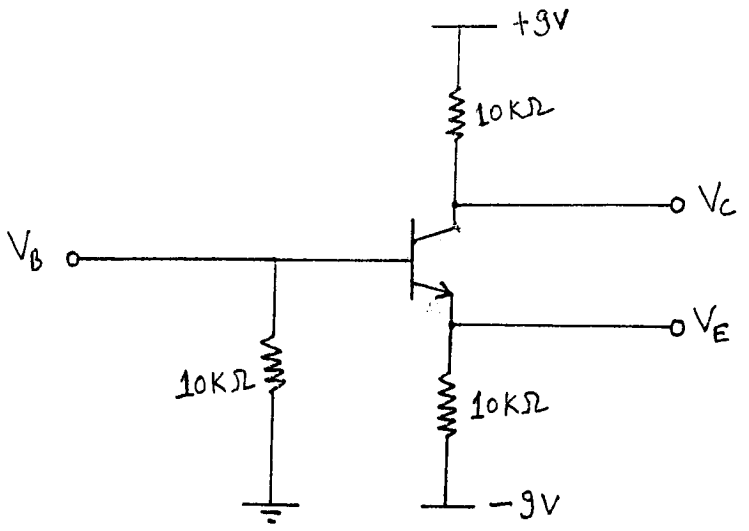

Figure 1 :

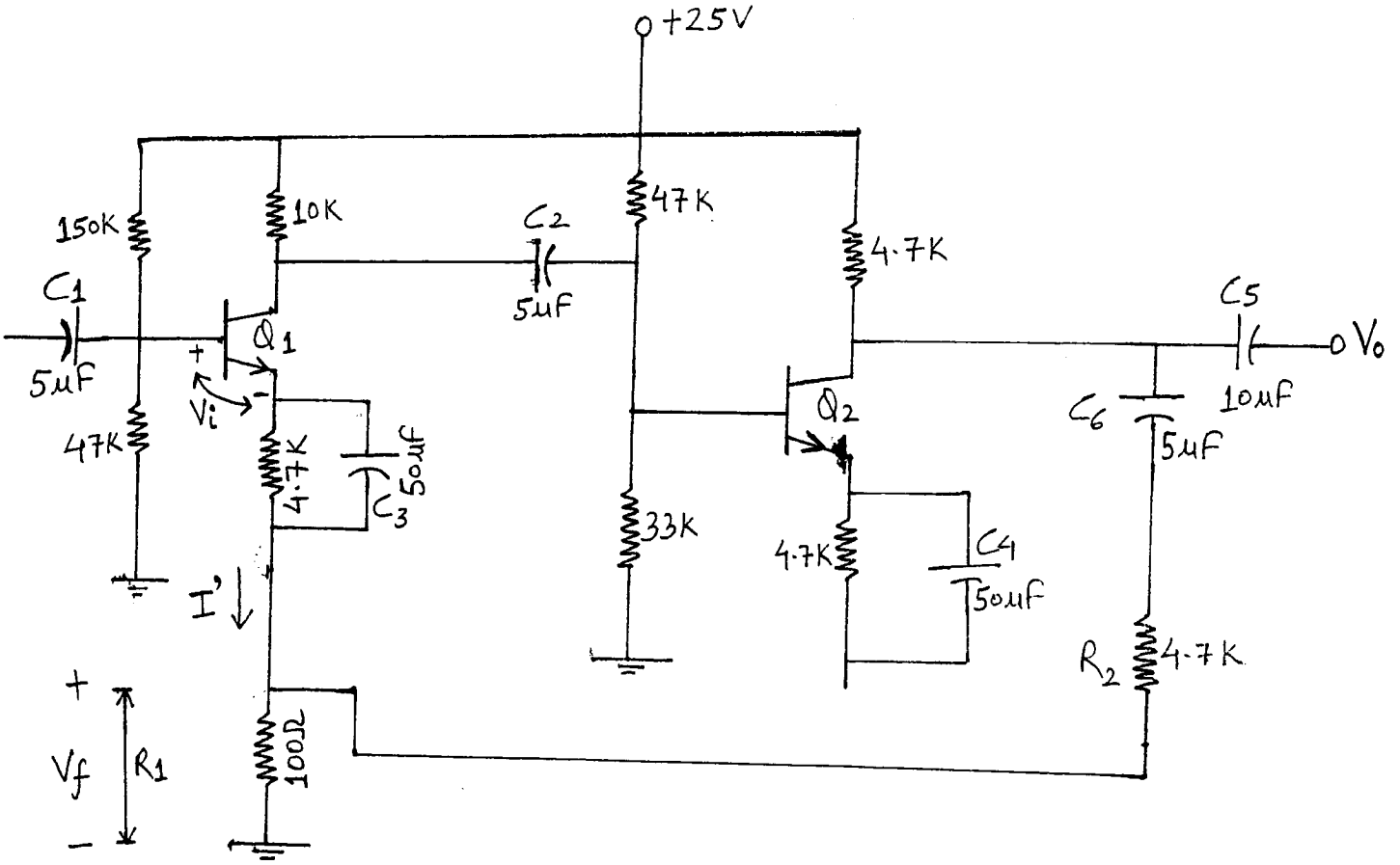

Figure 2 :

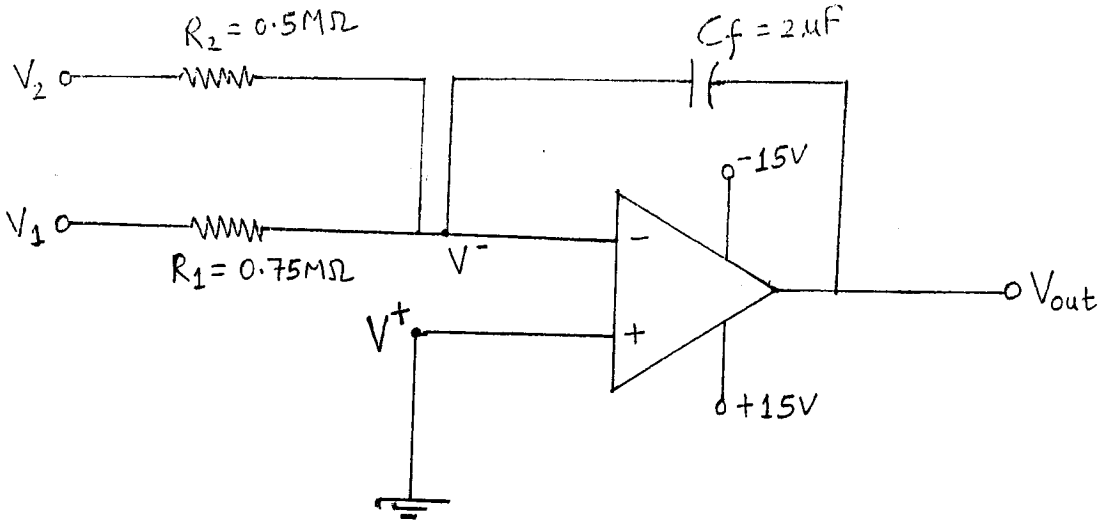

Figure 3:

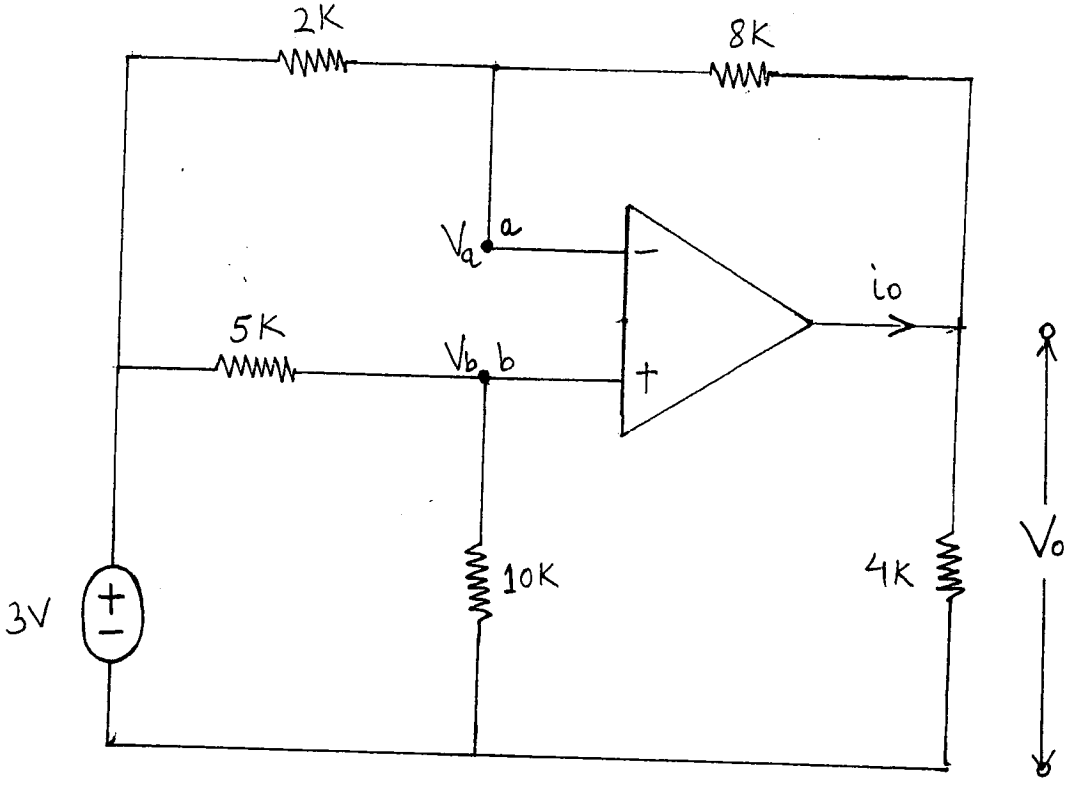

Figure 4:

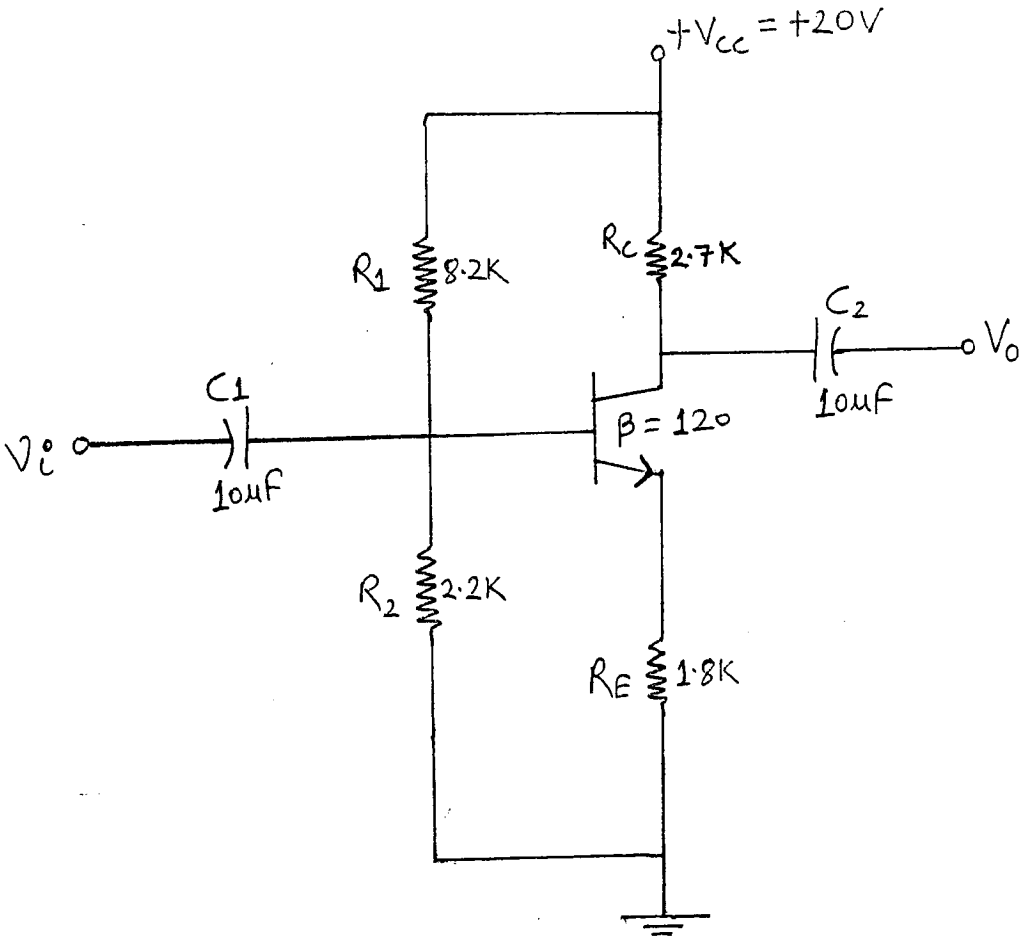

Figure 5 :

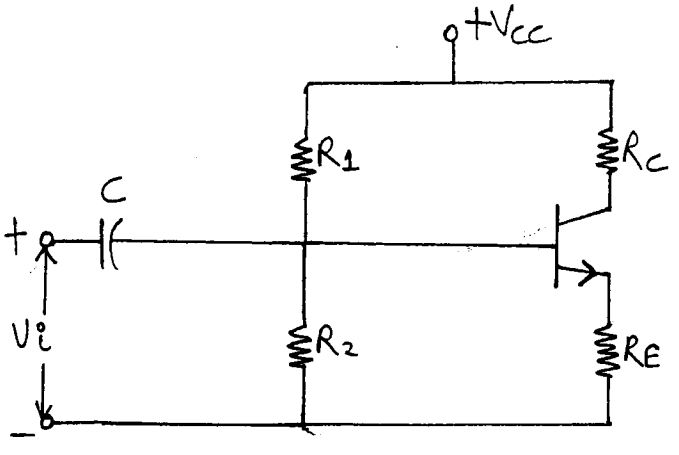

Figure 6 :

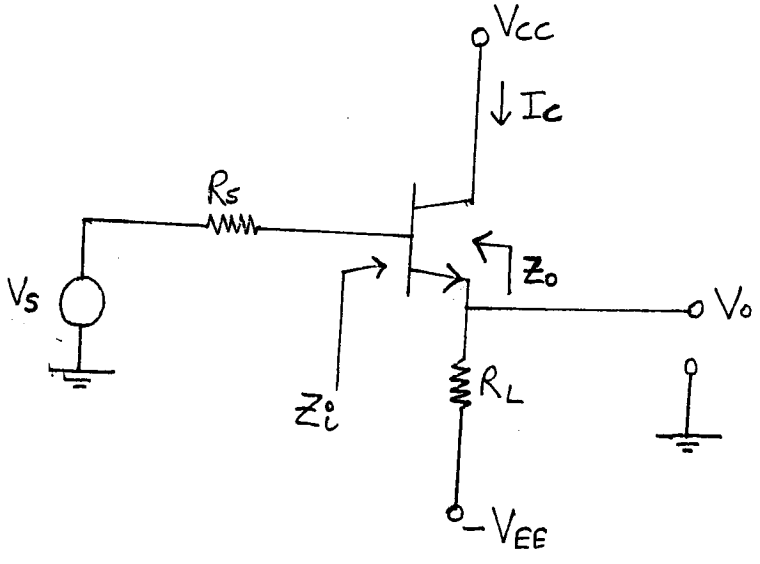

Figure 7: