BITS, PILANI - DUBAI
DUBAI INTERNATIONAL ACADEMIC CITY
FIRST SEMESTER 2009 – 2010
THIRD YEAR - EEE

Course Code: EEE C364
Course Title: Analog Electronics
Duration: 3 Hours
Component: Comprehensive Exam (Closed Book)

Date:24.12.09
Max Marks: 70 MARKS
Weightage: 35%

Note: 1. This question paper contains 7 Questions and has 4 pages.
2. Assume suitable data if required
3. Answer all Questions

Q1 (a) Explain in brief the differences between BJT and FET.

(b) Fig.1 shows the circuit of a two level clipper with clipping levels of **-3V** and **+5V**. Draw the output waveform when the input is sinusoidal of **5V rms** value. Assume the device to be ideal.

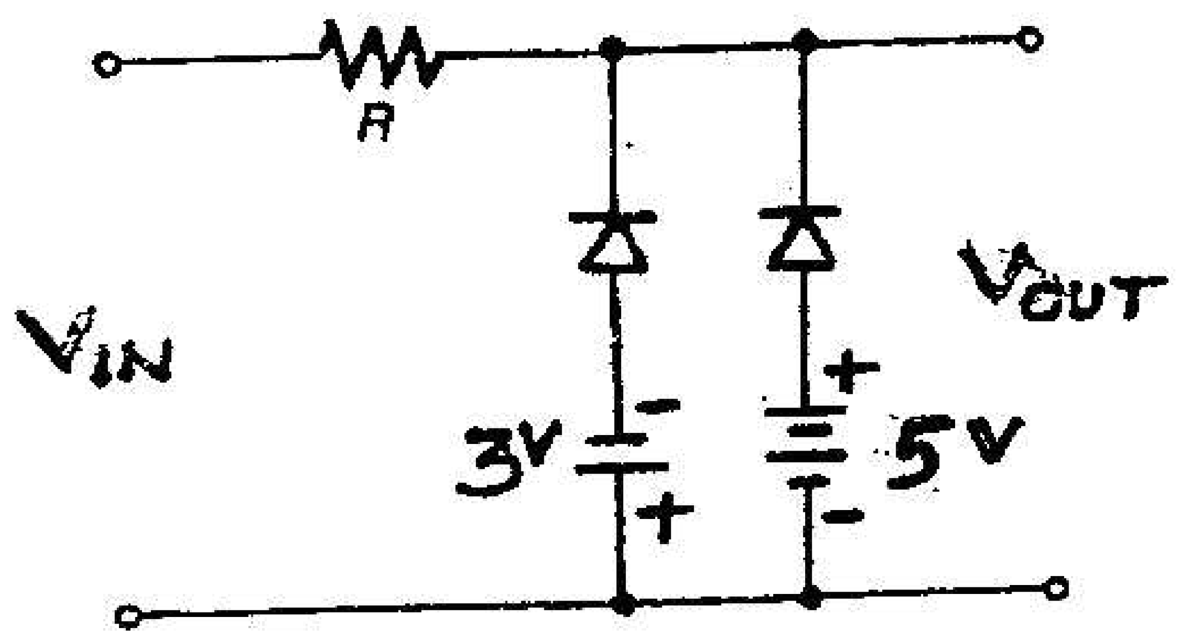


Fig.1

(C) Design a circuit using two ideal op-amps and resistors to implement the following summing function.

$$V_0 = 2V_1 + V_2 - 4V_3$$

Draw the complete circuit diagram.

(2+3+5M)

Q2(a) A Band pass filter can be formed by cascading high–pass and low-pass sections as shown in Fig.2. Calculate the lower cut-off frequency and upper cut-off frequency of the following band pass filter.

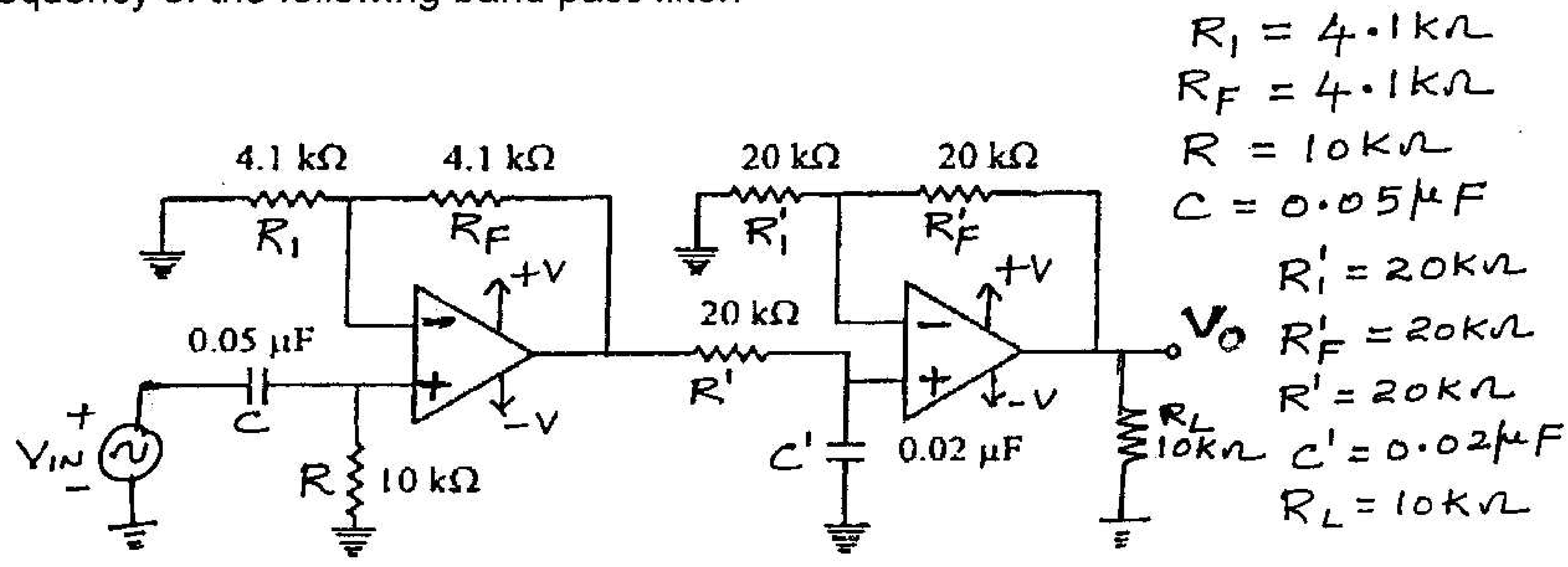


Fig.2

(b)Draw the circuit diagram of a logarithmic amplifier where the output is a logarithmic function of the input and derive an expression for output voltage Vo .

(5+5M)

Q3(a) For the circuit of Fig.3, the bridge is slightly unbalanced and the input voltages with respect to ground are **E_1 = 5V+ 2mV** and **E_2 = 5V - 2mV**.Determine the following

(i) the difference input signal voltage and

(ii) the common mode voltage

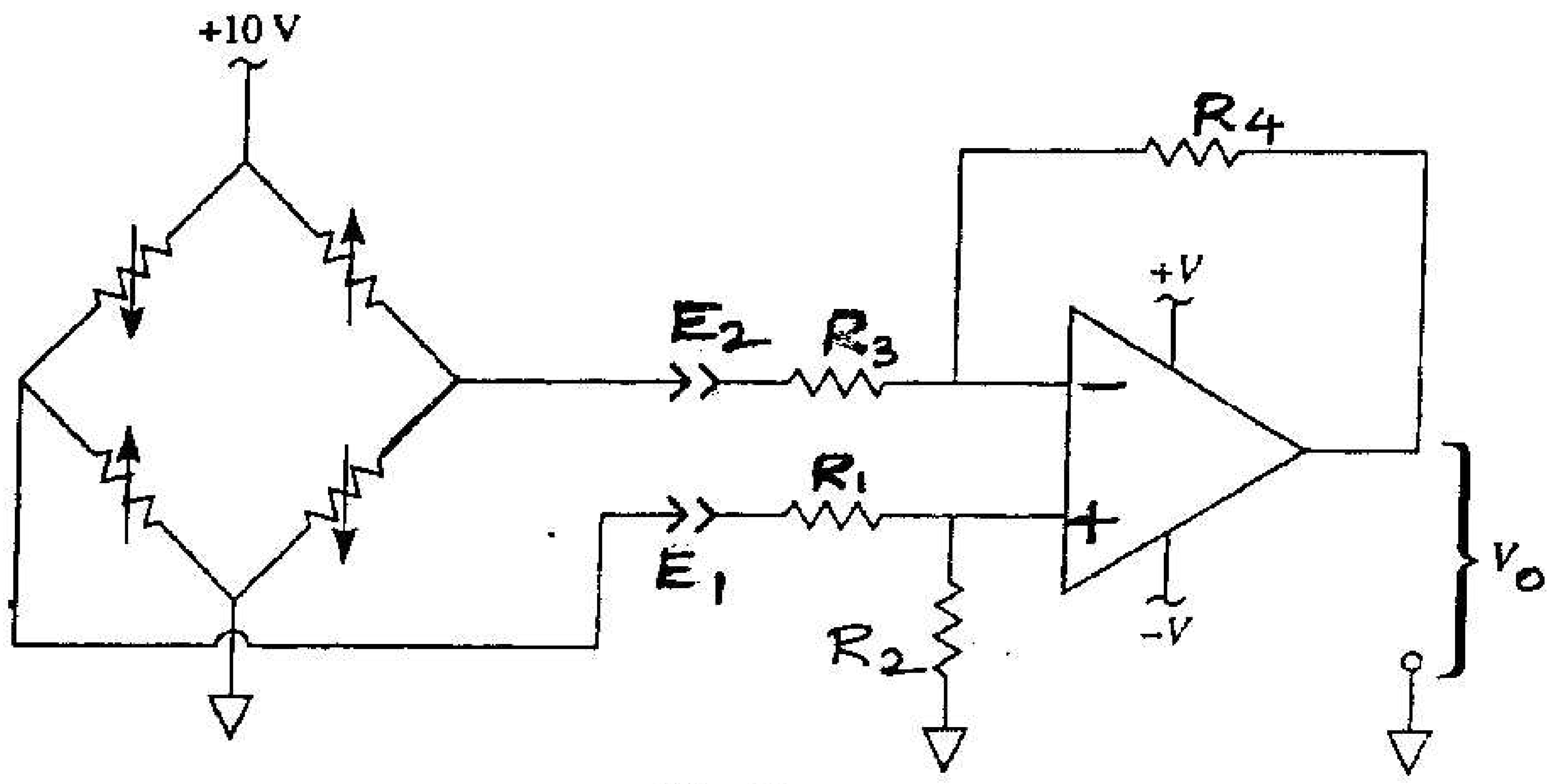


Fig.3

(b) Draw the circuit diagram of class B power amplifier and derive an expression for power conversion efficiency. (5+5M)

Q4(a) Positive or regenerative feedback is an essential characteristic of all oscillator circuits. Why, then, do comparator circuits utilizing positive feedback not oscillate? Instead of oscillating, the output of a comparator circuit with positive feedback simply saturates to one of its two rail voltage values. Explain this.

(b) Calculate the frequency of a Wien bridge oscillator circuit shown in Fig.4 when **R = 10kΩ** and **C = 2400pF**.

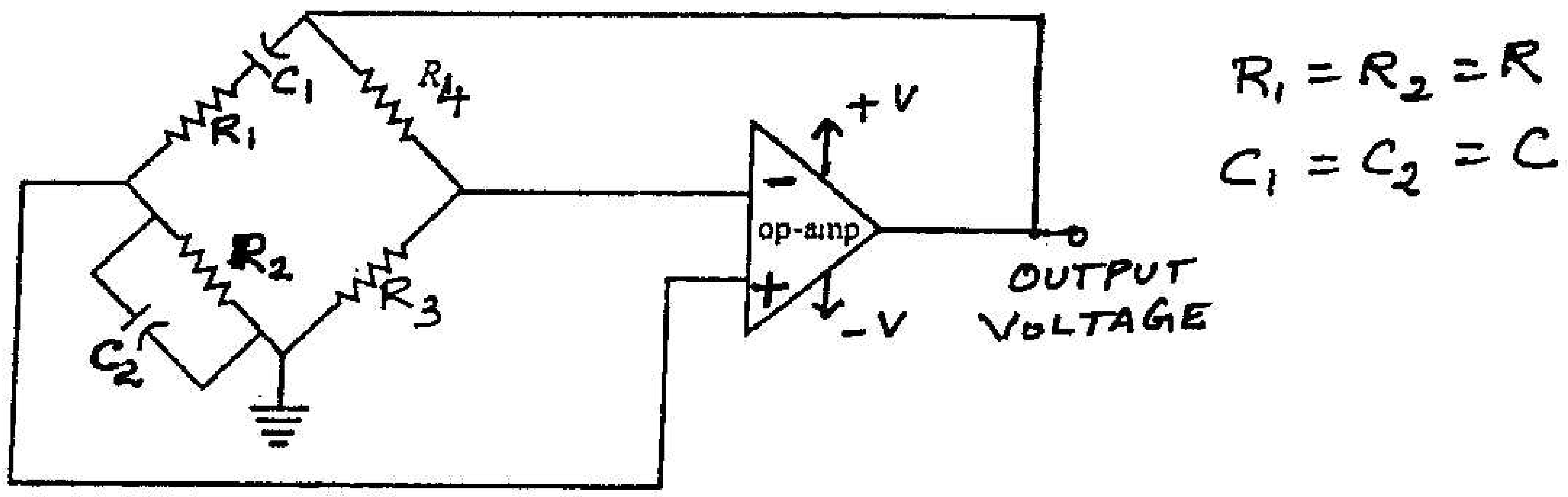


Fig.4 (5+5M)

Q5(a) Suppose that a "noisy" AC signal of otherwise constant frequency is connected to the input of a phase-locked loop circuit shown in Fig.5:

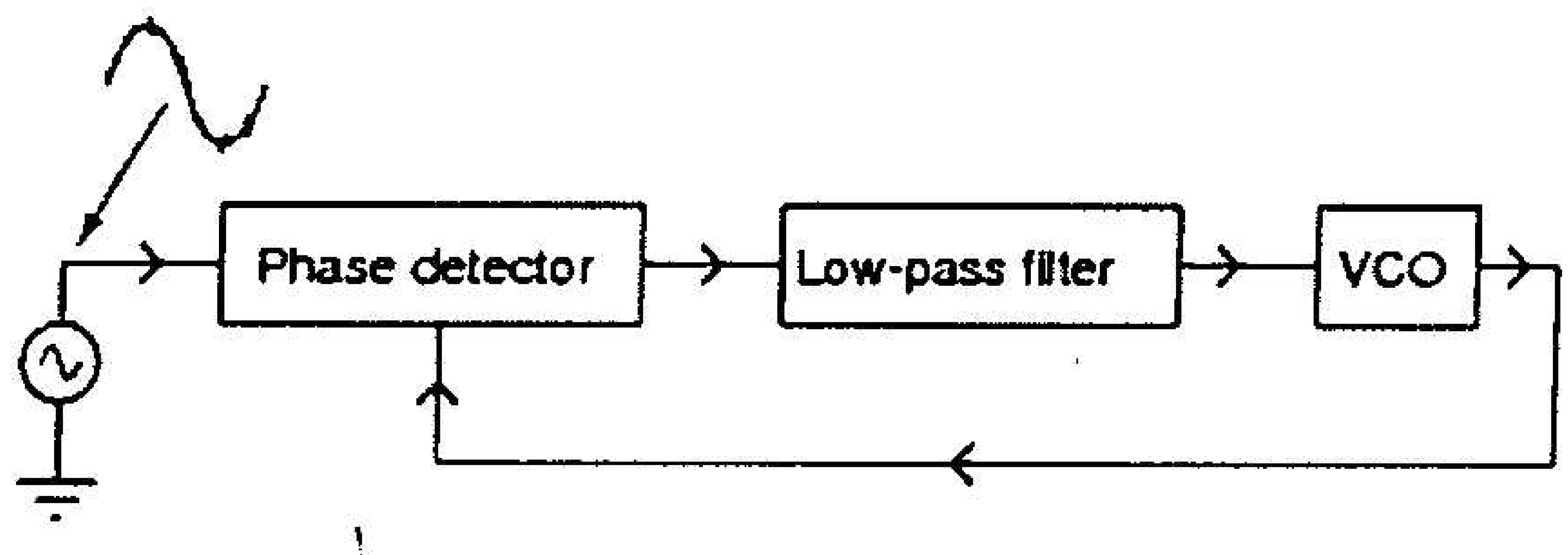


Fig.5

Characterize the output waveform generated by the VCO. Will it be "noisy"? Justify your answer.

(b) Draw the circuit diagram of Monostable Multivibrator using 555 timer and using a capacitor value of **C = 1nF**, find an appropriate resistor value to produce an output pulse of **20μs**. (5+5M)

Q6(a) Draw the circuit diagram of basic buck regulator and explain its principle of operation with respect to the following

(i) When the switch turns ON and

(ii) When the switch is turned OFF

(b) The figure below (Fig.6) shows a digital to analog converter with binary weighted resistors.

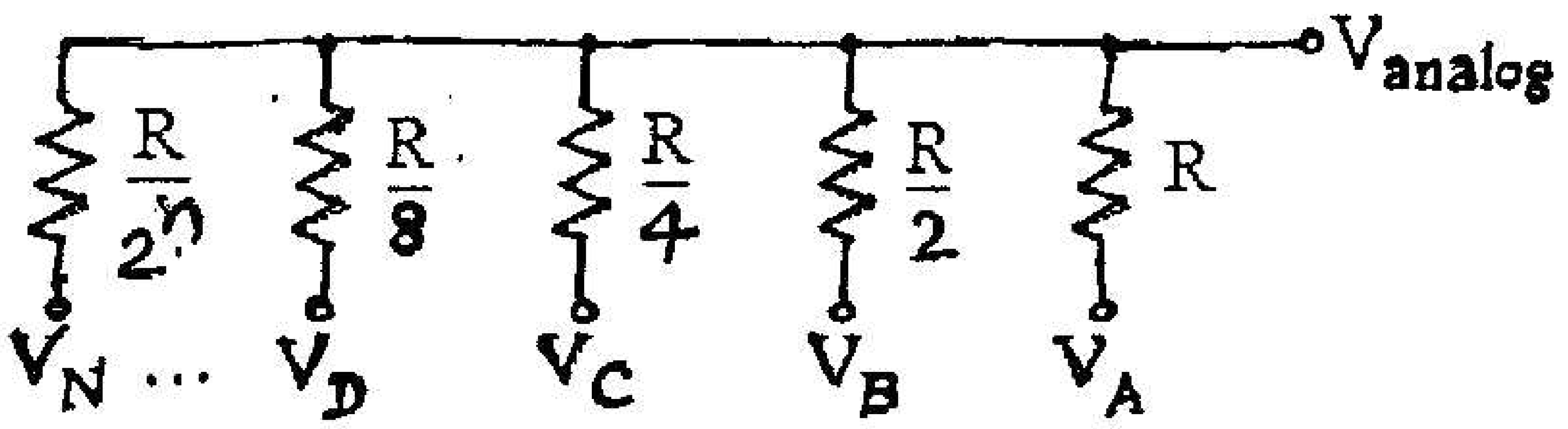


Fig.6

Prove that

$$V_{analog} = \frac{V_A + 2V_B + 4V_C + 8V_D + \ldots}{1 + 2 + 4 + 8 + \ldots}$$

(Vanalog)

(5+5M)

Q7(a)The Small-signal model for a single-tuned amplifier is shown below(Fig.7).For this mode it is known that transconductance **(g_m) =40x10$^{-3}\Omega^{-1}$** and **R_1 = 1kΩ**.

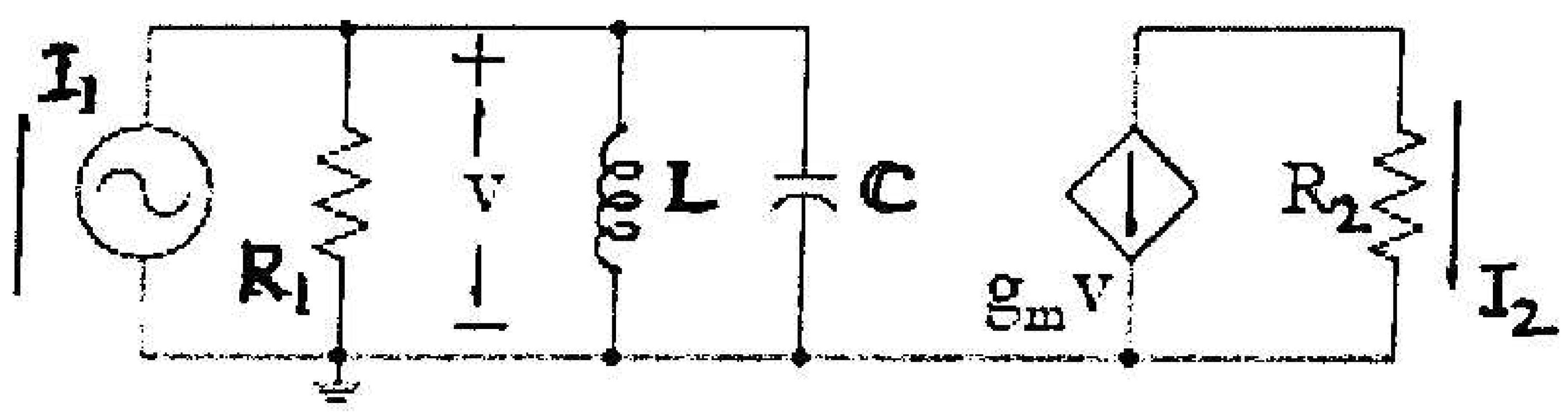


Fig.7

(i) Determine the values of L and C so that the amplifier will have a resonant frequency of **100KHZ** and a half-power bandwidth of **5KHZ**.

(ii) Determine the Current gain at the resonant frequency.

(b) Explain the advantages and limitations of IC Temperature sensors (5+5M)

******************END OF PAPER*******************

BITS, PILANI – DUBAI
FIRST SEMESTER 2009 – 2010
THIRD YEAR - EEE

Course Code: EEE C364 Date:6.12.09
Course Title: Analog Electronics Max Marks: 30 Marks
Duration: 50 Minutes Weightage: 15% Component: Test II (Open Book)

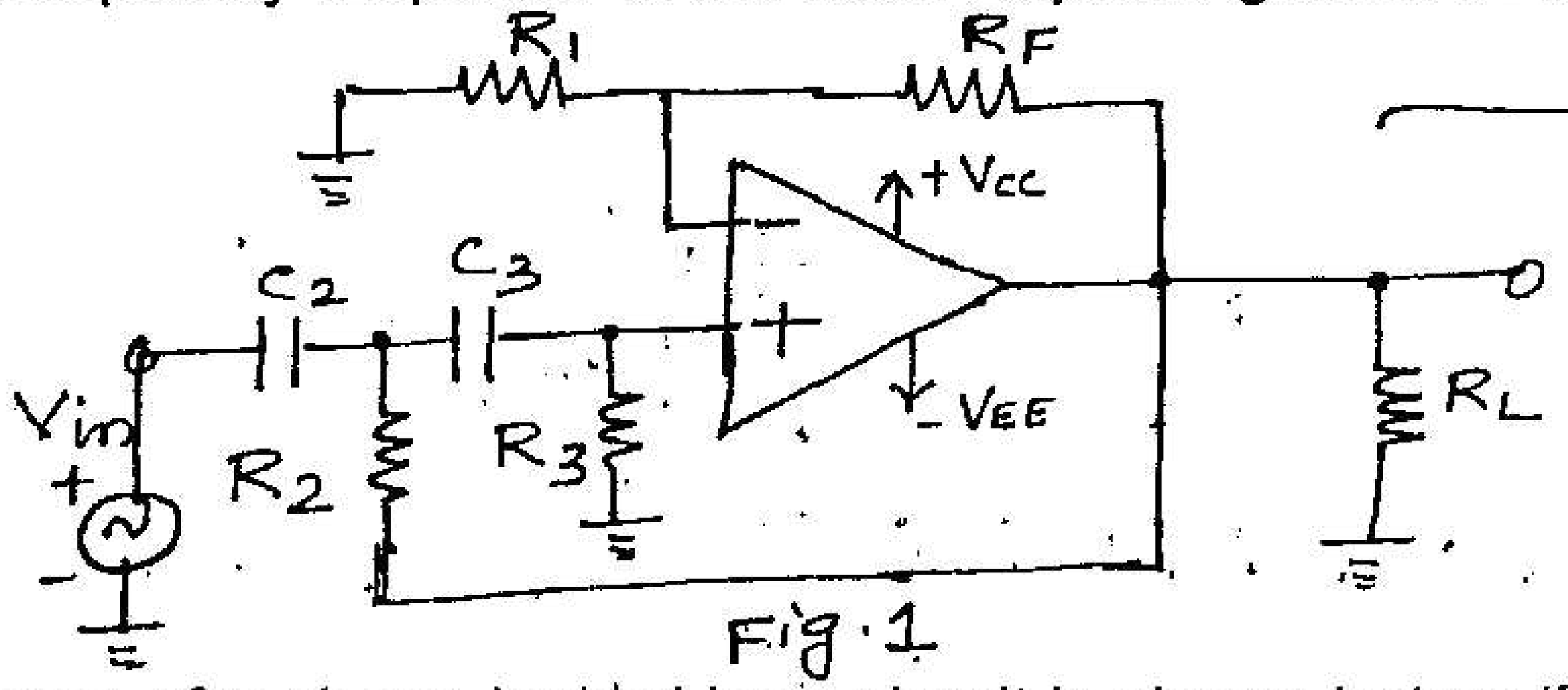
Note: Semilog graph sheet is provided along with question paper
Assume suitable data if required

Answer ALL Questions

Q1 (a) Find the lower cut off frequency for the second order high pass Butterworth filter shown in Fig.1.

(b) Also find the pass band gain of the filter and

(c) Plot the frequency response of the filter. Express gain in decibels. [2 + 2 + 6 M]



$R_1 = 27 k\Omega$
$R_F = 15.8 k\Omega$
$C_2 = C_3 = 0.01 \mu F$
$R_2 = R_3 = 16 k\Omega$
$R_L = 10 k\Omega$

Fig.1

Q2 A block diagram of a phase-locked loop circuit is shown below.(Fig.2):

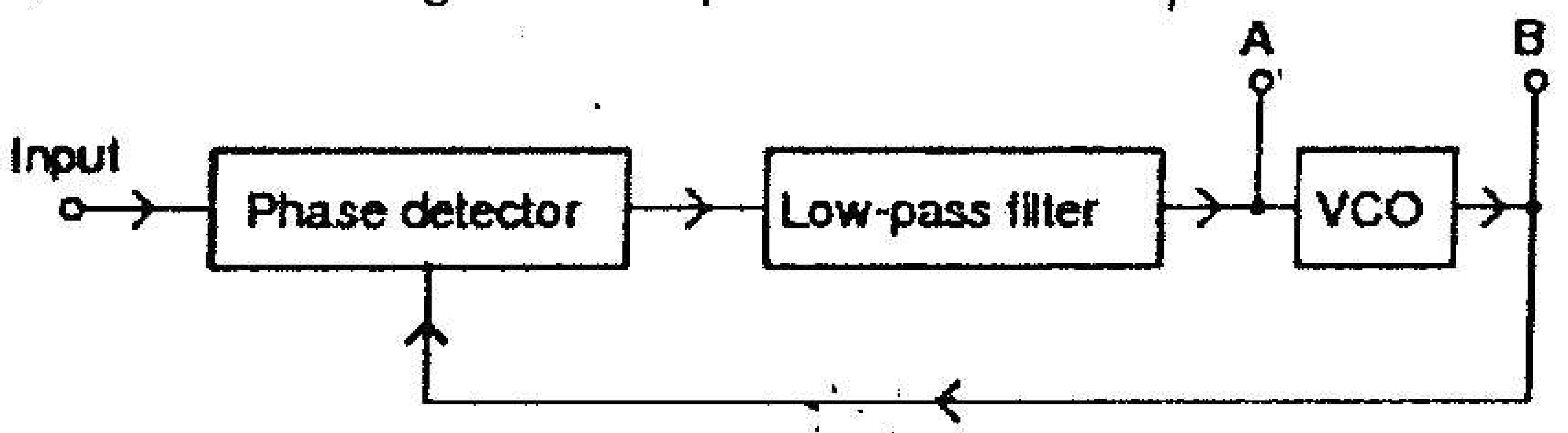


Fig.2

Determine what type of electronic signals would be seen at points A and B for the following input conditions:

(i) Input = sine wave, steady frequency

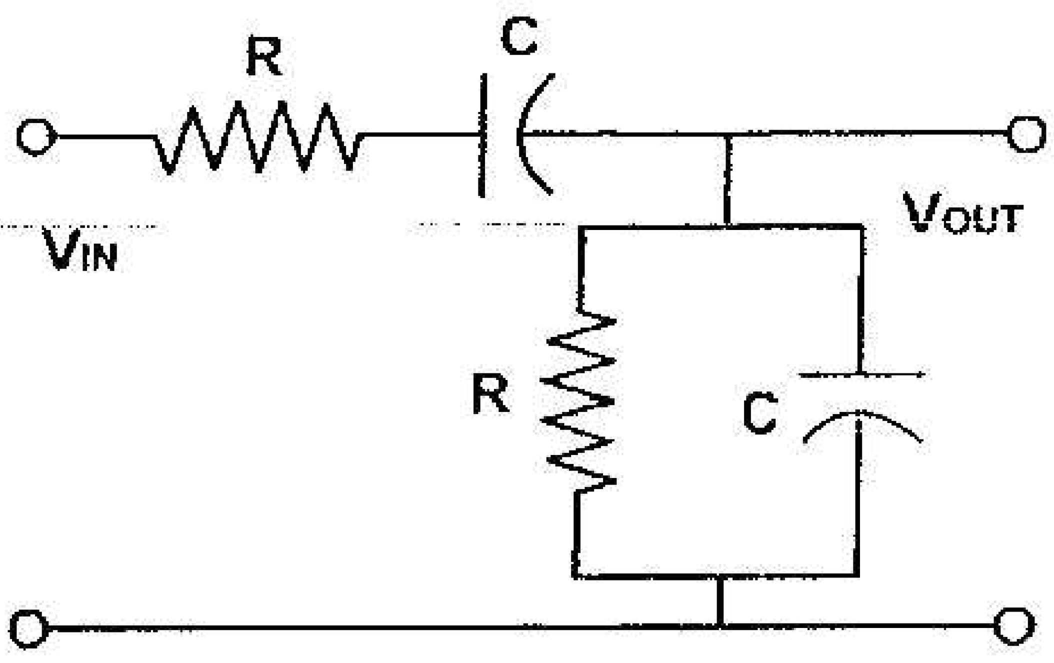
(ii) Input = sine wave, increasing frequency

(iii) Input = sine wave, decreasing frequency

(iv) Input = sine wave, frequency increases and decreases regularly [4M]

P.T.O

Q3 The Wien Bridge oscillator uses a feedback circuit called a lead lag network as shown in **Fig.3,** Prove that $\dfrac{V_{OUT}}{V_{IN}} = \dfrac{R X_C \{3 R X_C - j(R^2 - X_C^2)\}}{(R^2 - X_C^2)^2 - (3jR X_C)^2}$

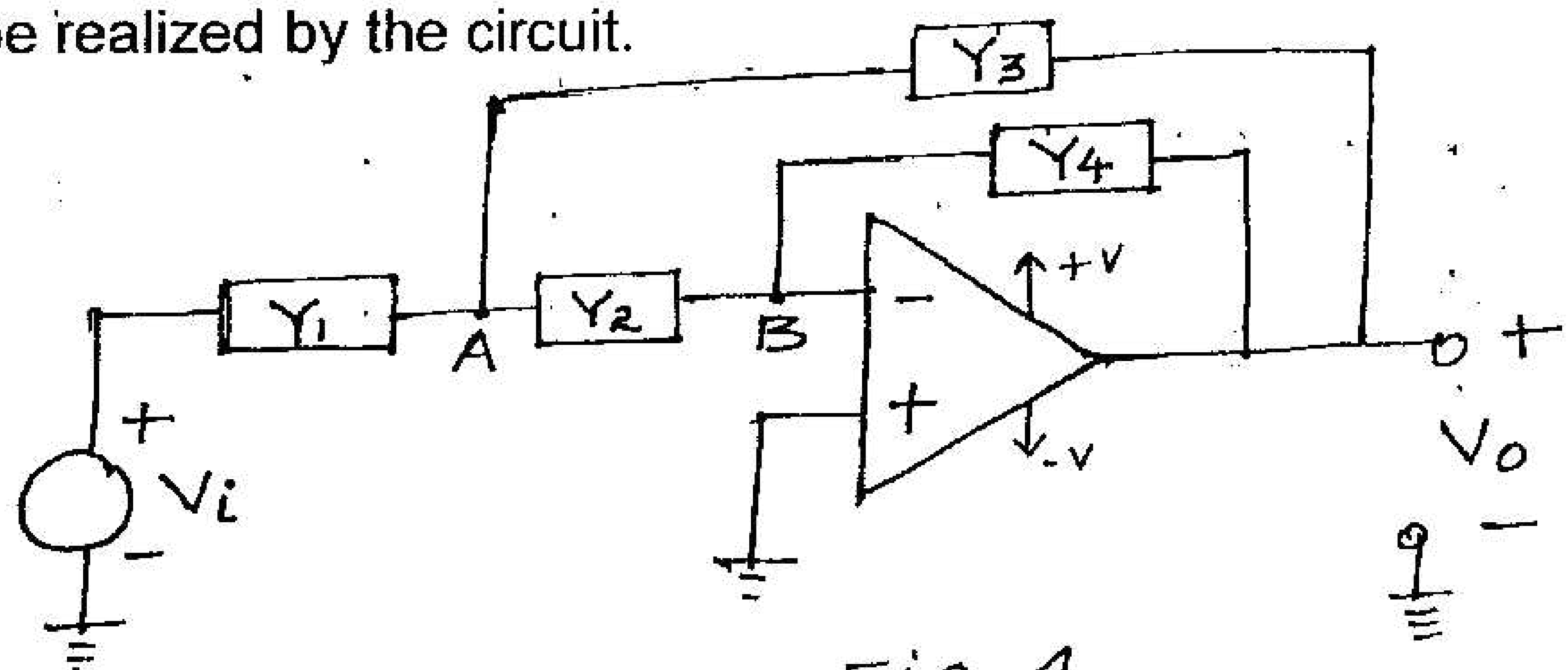


[5 M]

Fig.3

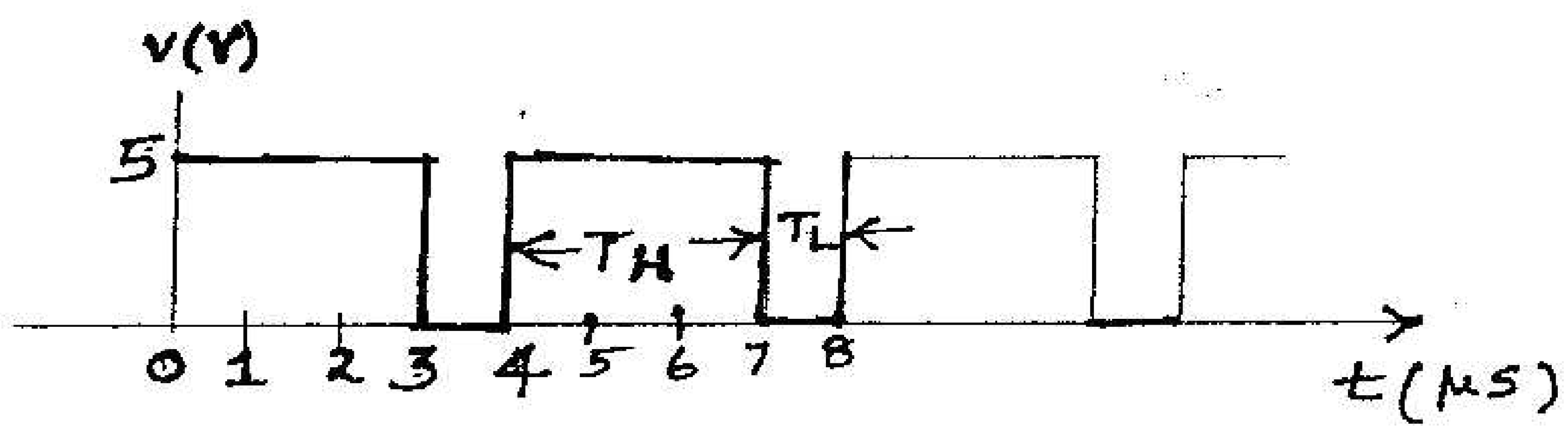
Q4 (a) Obtain the transfer function for the circuit shown in Fig.4. Assume the OPAMP to be ideal. Y_i represent the admittance of branch i.

(b) If $Y_1 = C_1 S$, Y4 = C_4S, $Y_2 = G_2$, $Y_3 = G_3$, what is the order of the filter that will be realized by the circuit. [5 M]



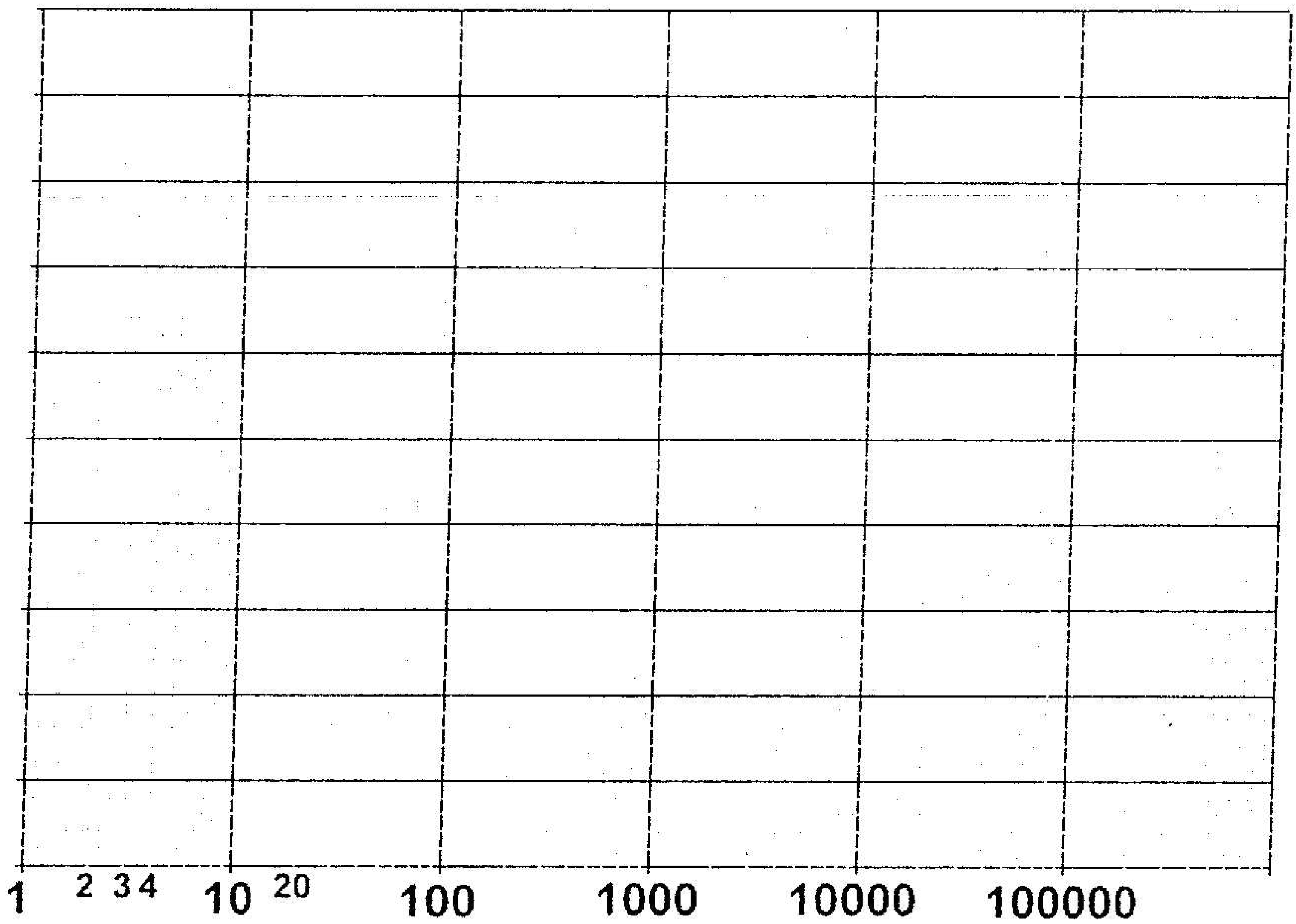
Fig·4

Q5 An Astable Multivibrator using 555 timer has V_{cc} = 5V and C = 1 nF, find the values of the resistors R_A and R_B so that the circuit will produce the waveform shown in Fig.5 . [6 M]



Fig·5

END OF PAPER


1
2 3 4
10 20
100
1000
10000
100000

BITS, PILANI – DUBAI
DUBAI INTERNATIONAL ACADEMIC CITY
FIRST SEMESTER 2009 – 2010
TEST – I (CLOSED BOOK)

Course Code: EEE C364 THIRD YEAR -EEE Date: 11.10.09
Course Title: Analog Electronics Max Marks: 30
Duration: 50 Minutes Weightage: 15%

Answer All Questions

1(a) Given the information of the voltage divider bias circuit in **Fig.1**, draw the thevenin's equivalent circuit and determine the following

[13 Marks]

(i) I_c (ii) V_{CE} (iii) I_B (iv) V_B and (v) V_E

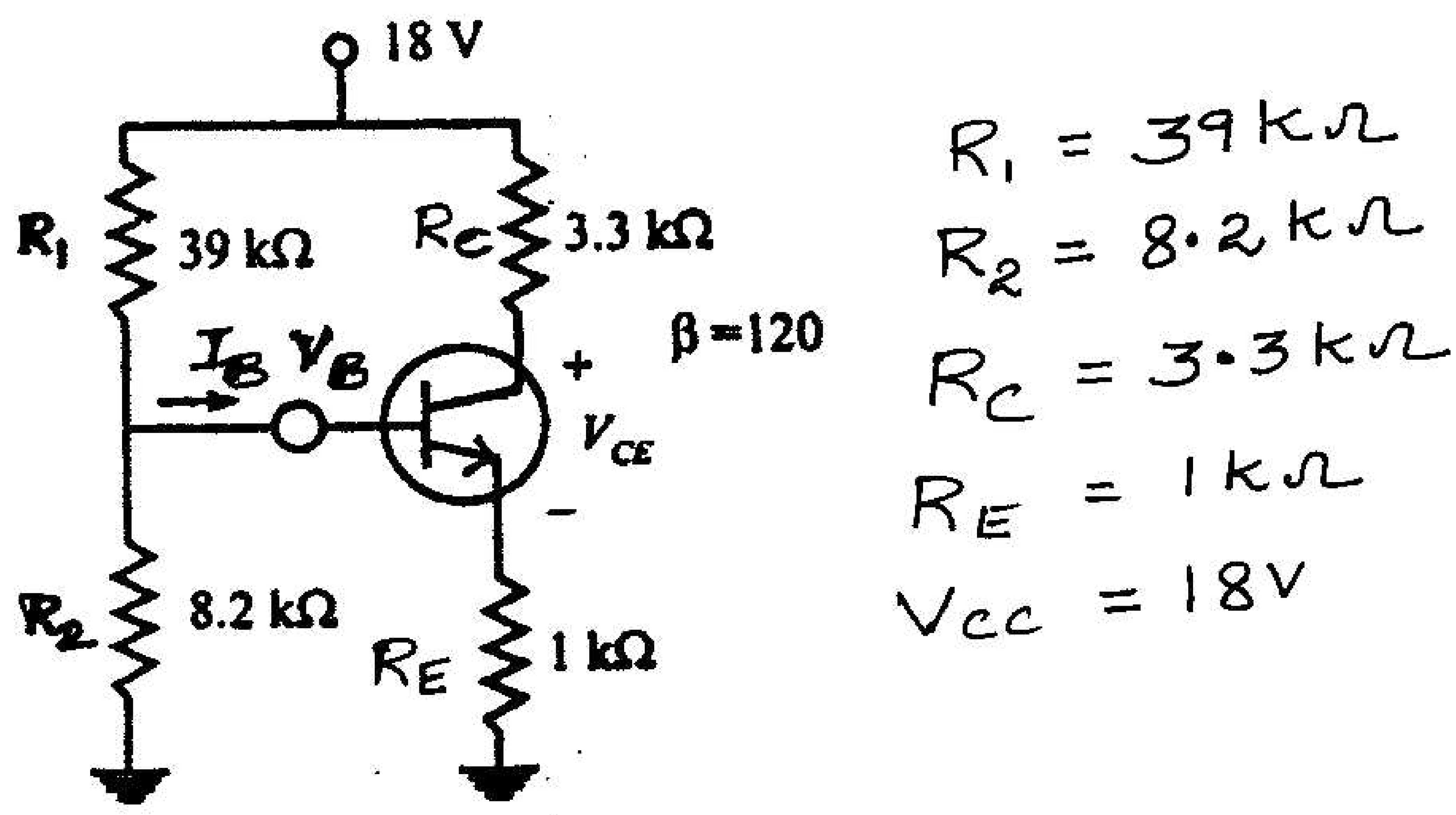


Fig.1

(b) What does the term transconductance mean, with reference to a Field-Effect Transistor (FET)? Is the transconductance function for a FET, a linear or a nonlinear relationship? **[2 Marks]**

2(a) What input voltage (V_i) results in an output of **2.4V** in the circuit shown in **Fig.2**?

[5 Marks]

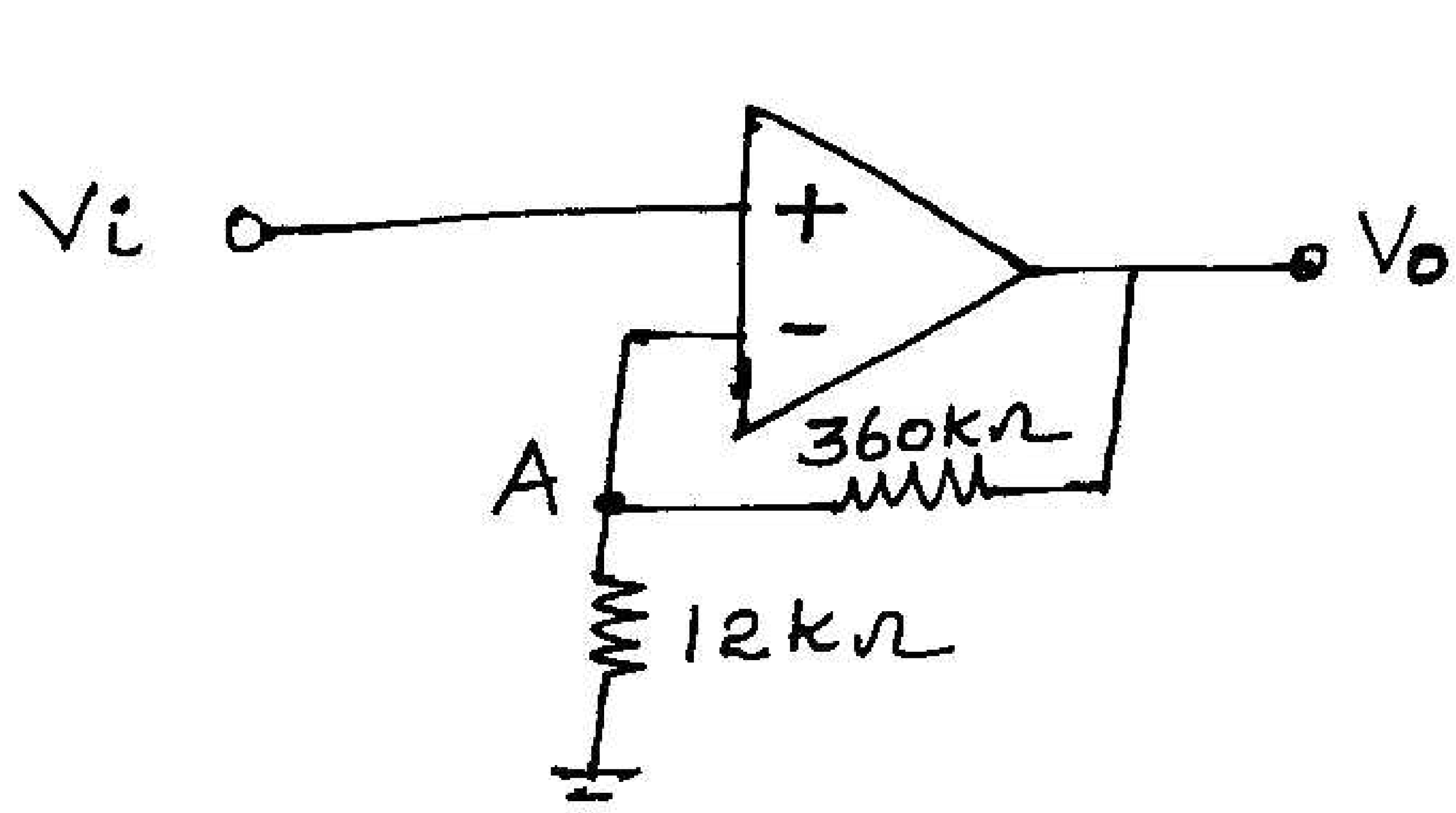


Fig.2

[P.T.O]

(b) Find an expression for the output V_0 of the amplifier circuit of **Fig.3**.Assume an ideal OPAMP. **[5 Marks]**

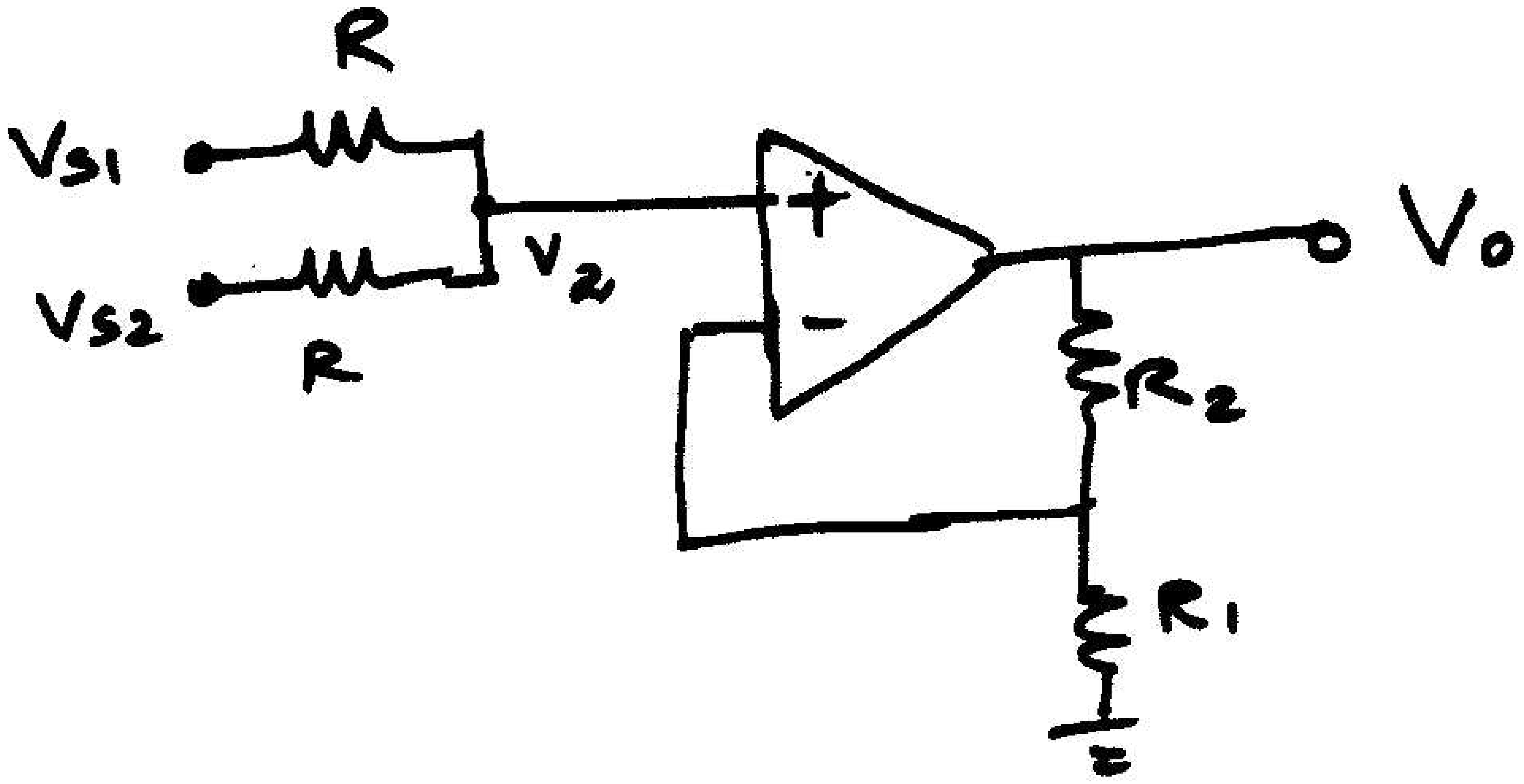


Fig.3

(c) Find the gain of V_O / V_i of the circuit of **Fig.4** **[5 Marks]**

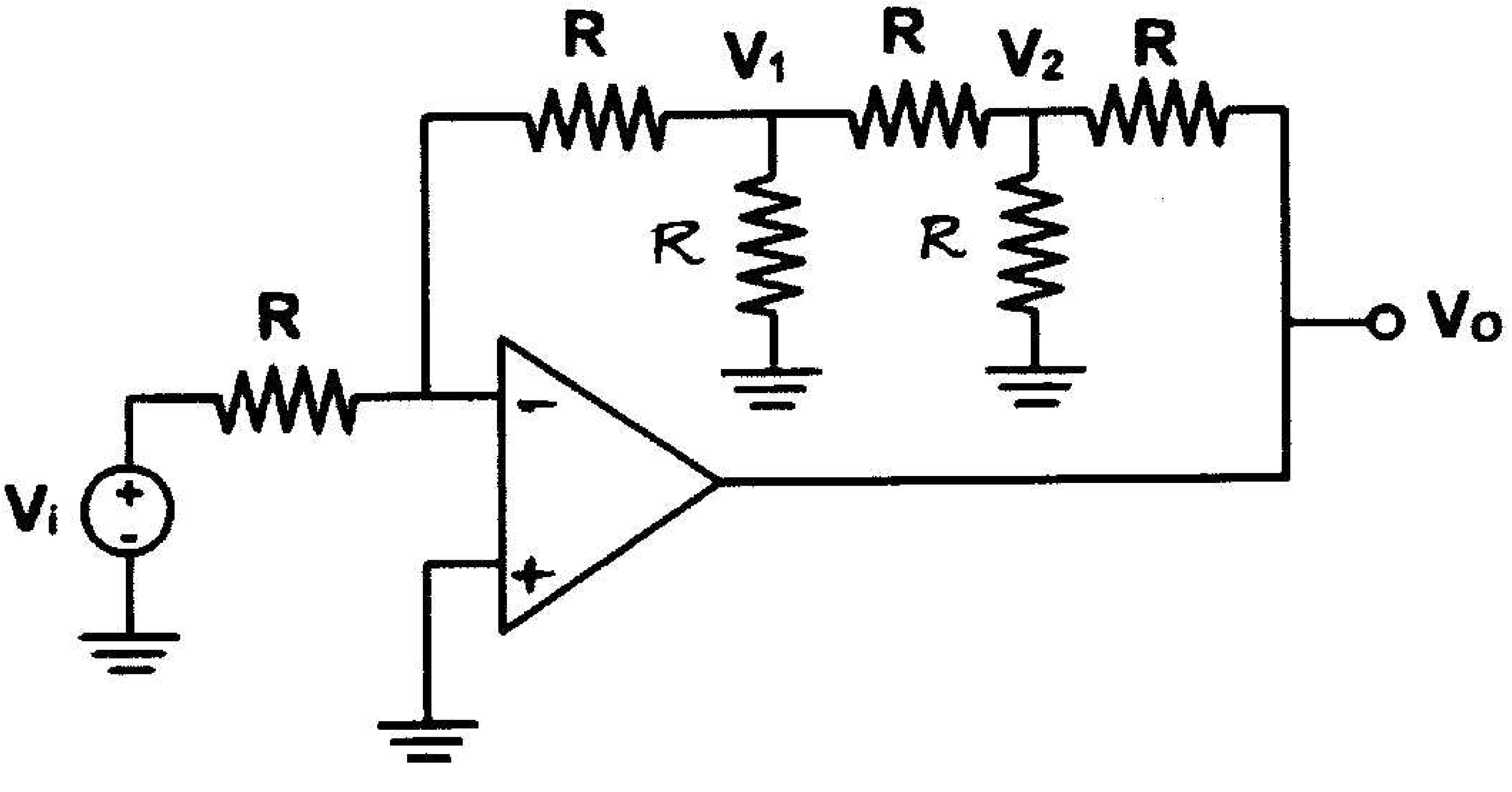


Fig.4

--END--

BITS, PILANI – DUBAI
FIRST SEMESTER 2009 – 2010
THIRD YEAR - EEE

Course Code: EEE C364 Date:11.11.09
Course Title: Analog Electronics Max Marks: 10
Duration: 20 Minutes (SET A) Weightage: 5%
Component: Quiz II (Closed Book)
Name: **ID No:** **Prog: EEE**

Note: This question paper contains 7 Questions and has 4 pages
Assume suitable data if required
Answer ALL Questions

1. Draw a complete op-amp circuit that *divides* one quantity **(x)** by another quantity **(y)** using logarithms. Initial logarithmic op-amp modules are shown in Fig.1 &2.

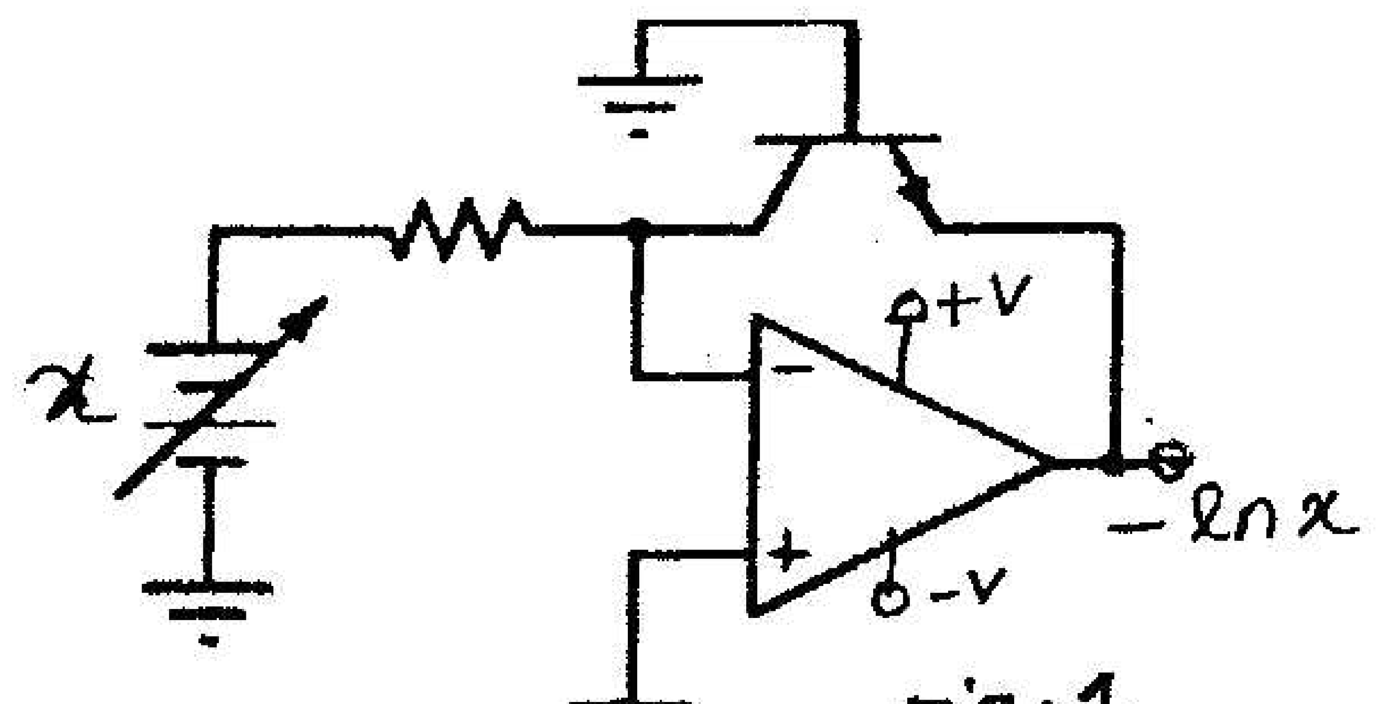


Fig.1

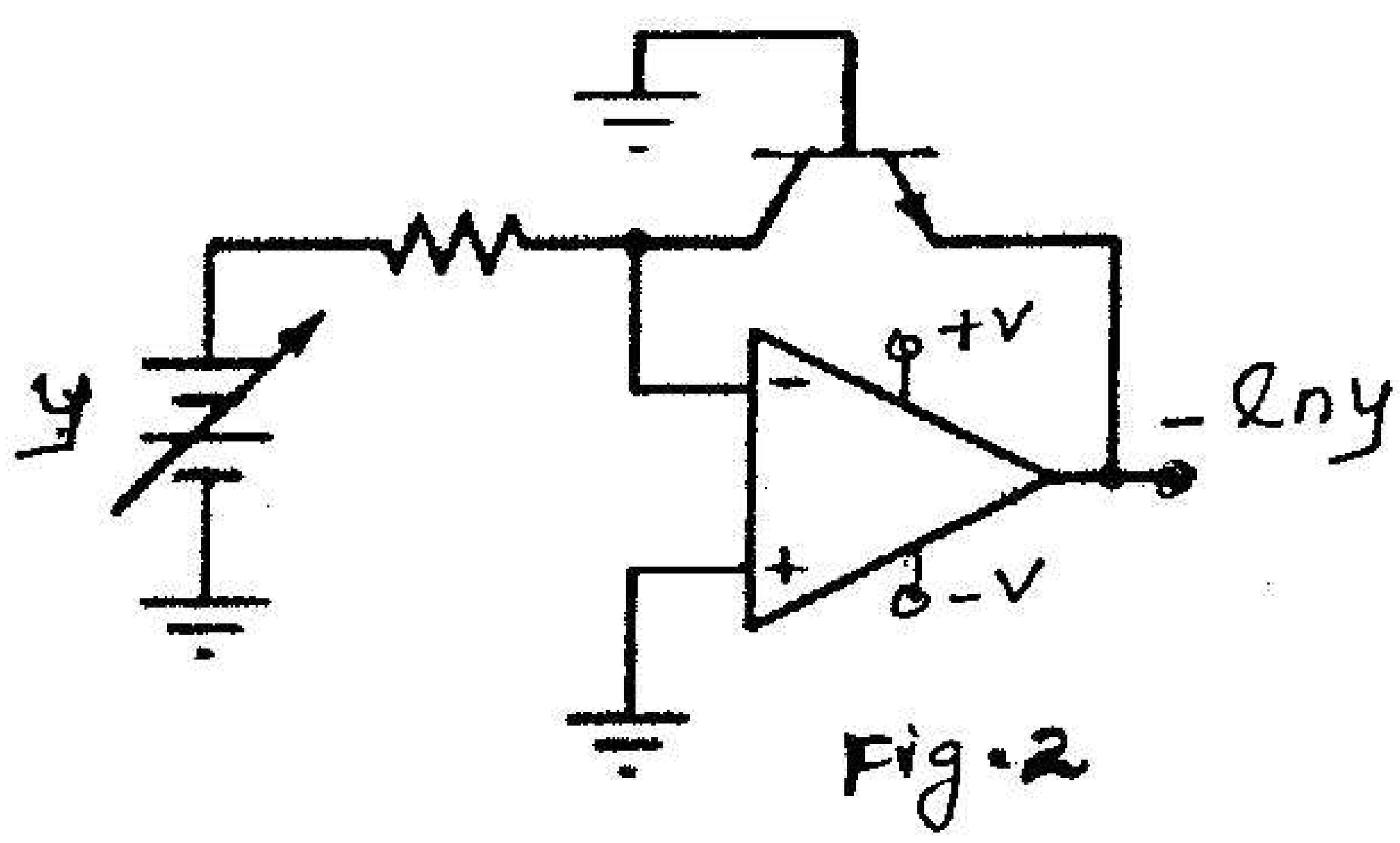


Fig.2

(2 Marks)

P.T.O

2. Sketch the input voltage and output voltage for the circuit shown below (Fig.3) with $V_i = 5\ \mathrm{Sin}\omega t$, $R_f = 10k\Omega$ and $R_i = 1k\Omega$. Assume a Silicon diode. (1 Mark)

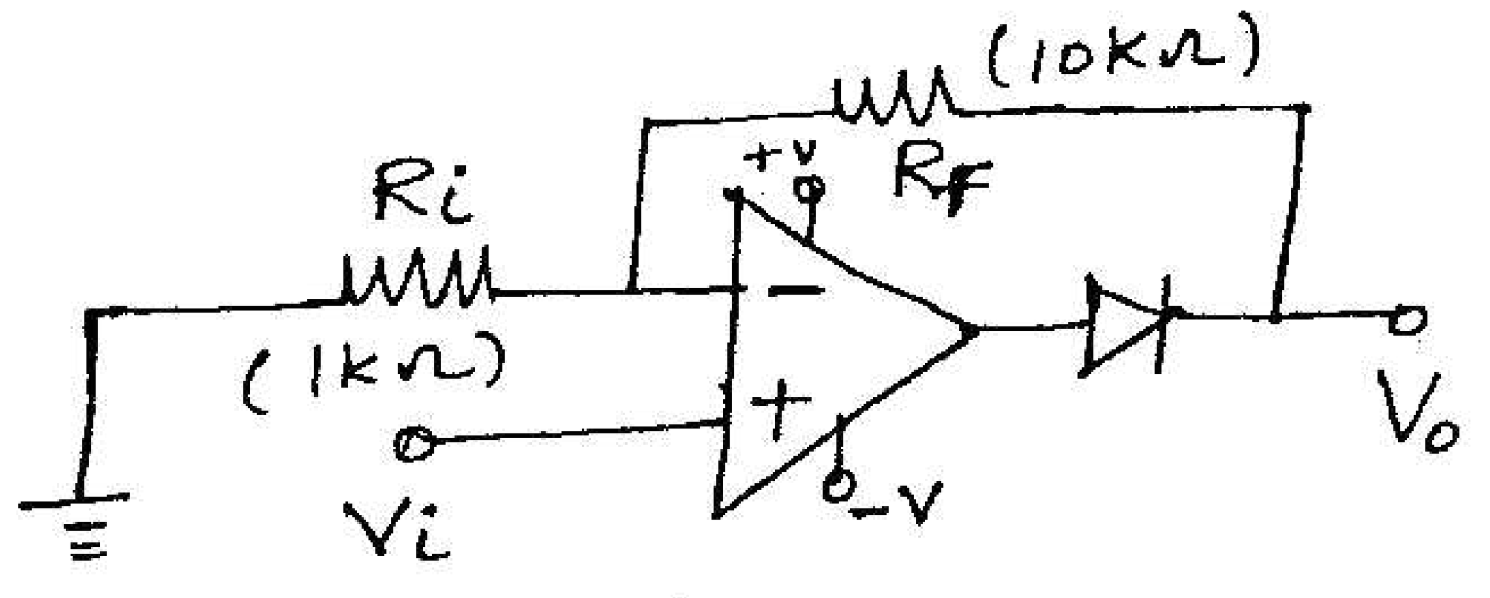


Fig.3

3. Using Opamps draw two schematic diagrams one block representing a log amplifier and another, an antilog amplifier. Show how the two blocks can be integrated to obtain an analog multiplier that gives an output xy for two inputs x and y.

(2 Marks)

4. The opamp circuit shown in Fig.4 is called a *precision rectifier*. Analyze its output voltage as the input voltage smoothly increases from -5 volts to +5 volts.

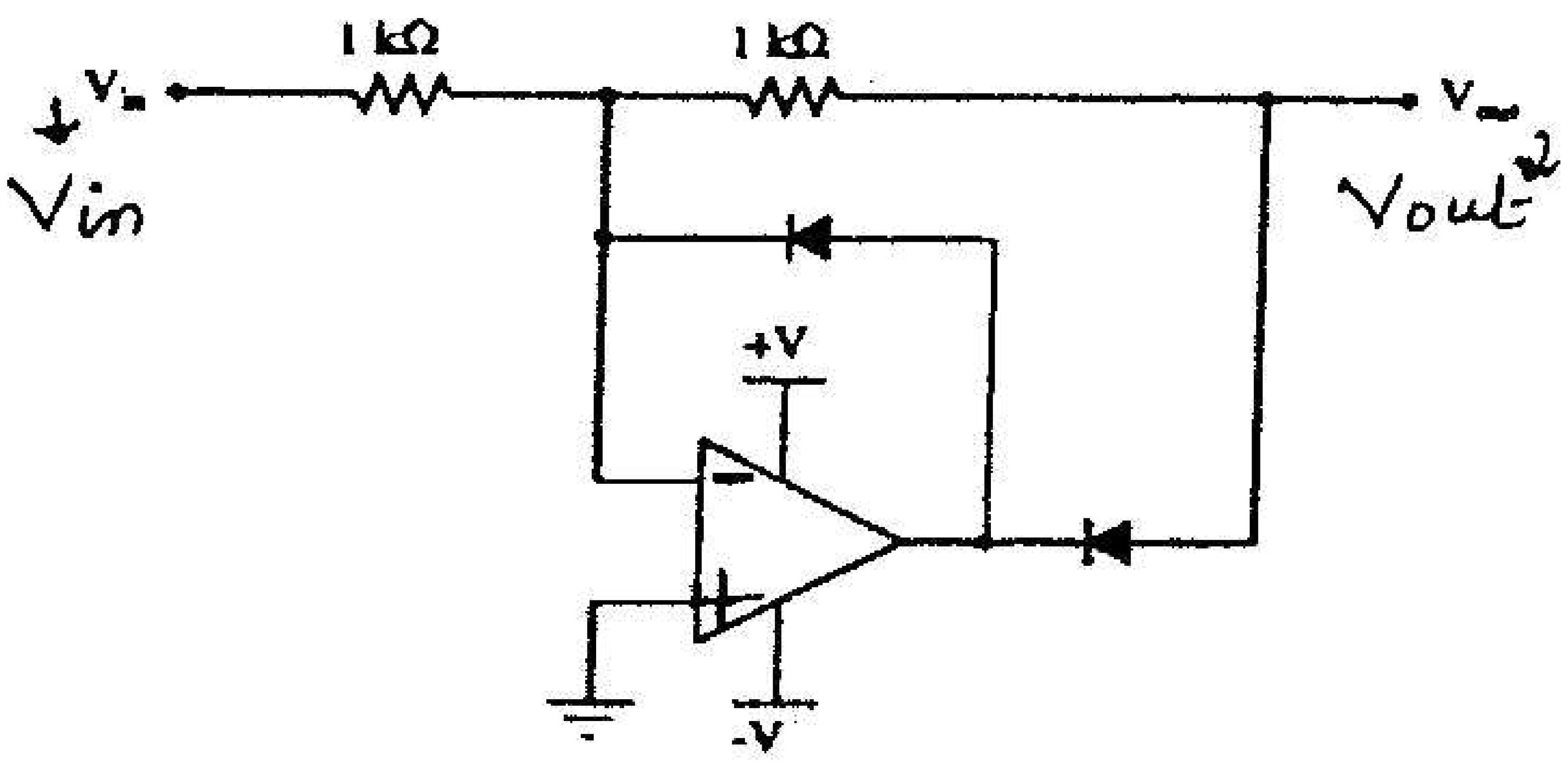
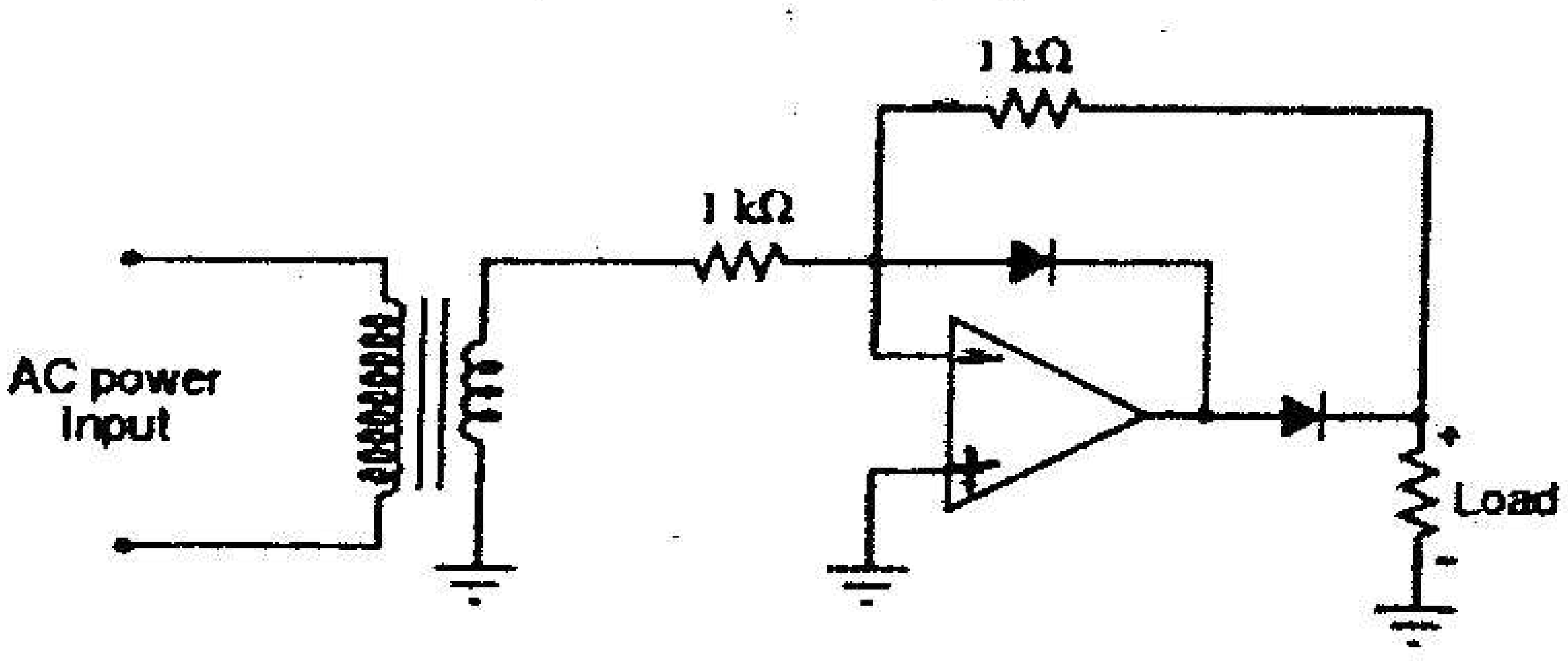


Fig.4

Assume that both diodes in this circuit are silicon switching diodes, with a nominal forward voltage drop of 0.7 volts. (1 Mark)

5. Explain why the following Opamp circuit (Fig.5)cannot be used as a rectifier in an AC-DC power supply circuit: (1 mark)

A precision power supply rectifier?



(Fig.5)

P·T·O

6. Draw the circuit diagram of inverting type Zero crossing detector and draw the input and output waveforms (2 marks)

7. Identify the circuit shown in Fig.6 and draw the input and output waveforms (1 mark)

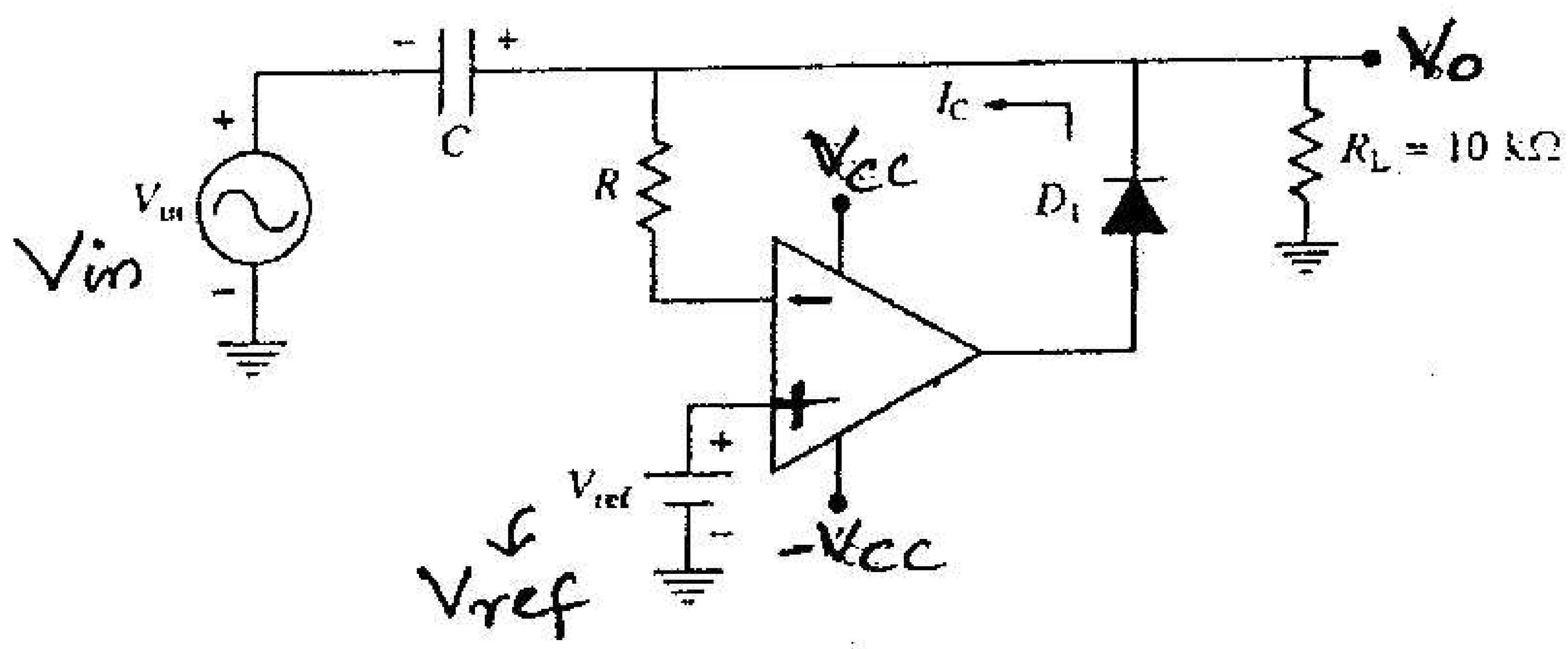


Fig.6

BITS, PILANI – DUBAI
FIRST SEMESTER 2009 – 2010
THIRD YEAR - EEE

Course Code: EEE C364
Course Title: Analog Electronics
Duration: 20 Minutes
Component: Quiz 1
Name:

(SET A)

ID No:

Date: 28.10.09
Max Marks: 10
Weightage: 5%

Prog: EEE

Answer all Questions
Assume suitable data if required

1. A series – shunt feedback amplifier employs a basic amplifier with input and output resistances each of 1kΩ and gain A = 2000V/V. The feedback factor β =0.1V/V.Find the gain A_f and the output resistance R_{of} of the closed-loop amplifier (2Marks)

2. A series – series feedback circuit represented in Fig.1 and using an ideal transconductance amplifier operates with V_s = 100mV, V_f = 95mV and I_0 = 10mA.What are the corresponding values of A and β? Include correct units for each. (2Marks)

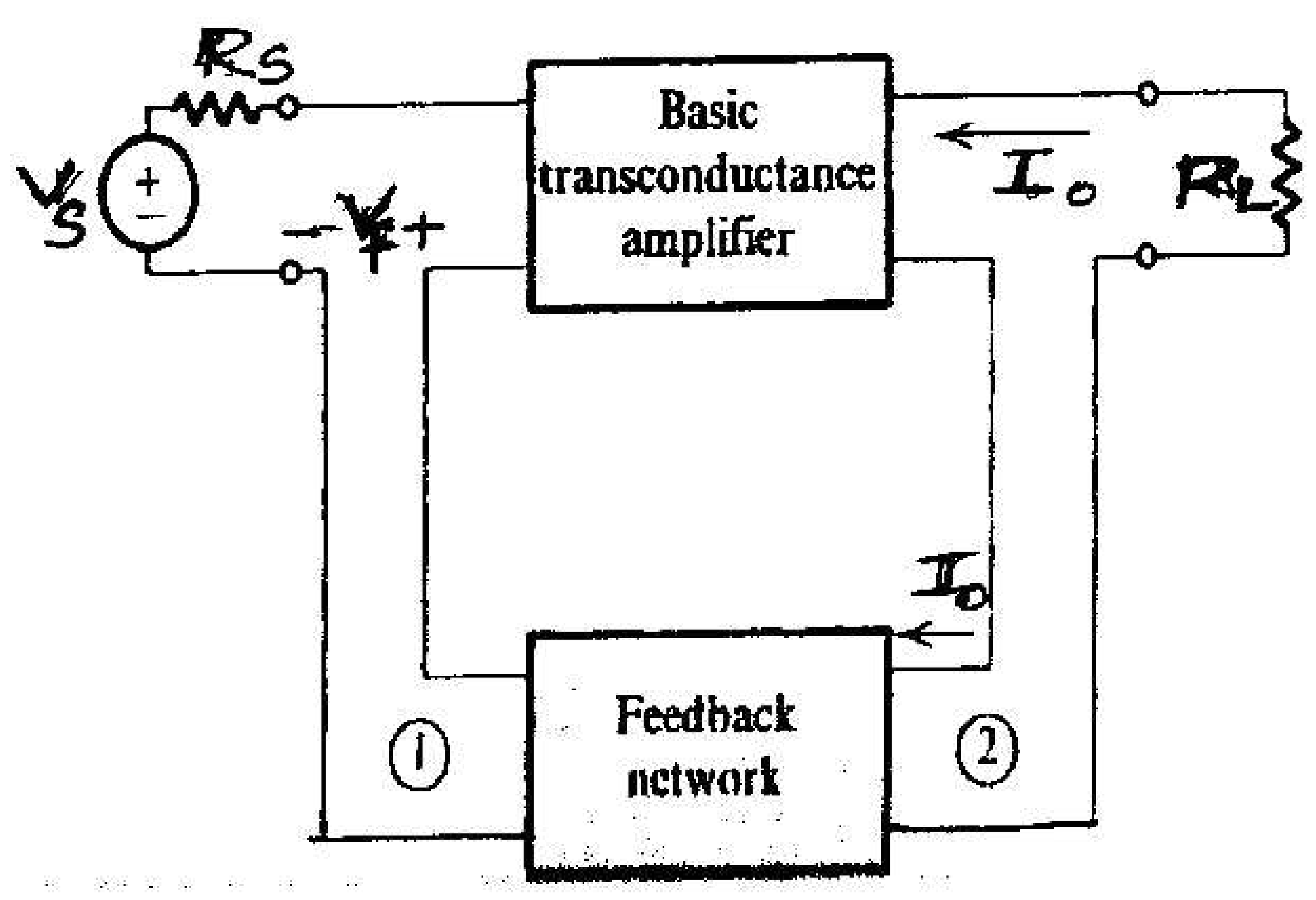


Fig.1

P.T.O

3. A shunt-series feedback amplifier represented in Fig.2 and using an ideal basic current amplifier operates with Is = 100μA, I_f = 90μA and I_o = 10mA. What are the corresponding values of A and β? Include the correct units for each.

(2Marks)

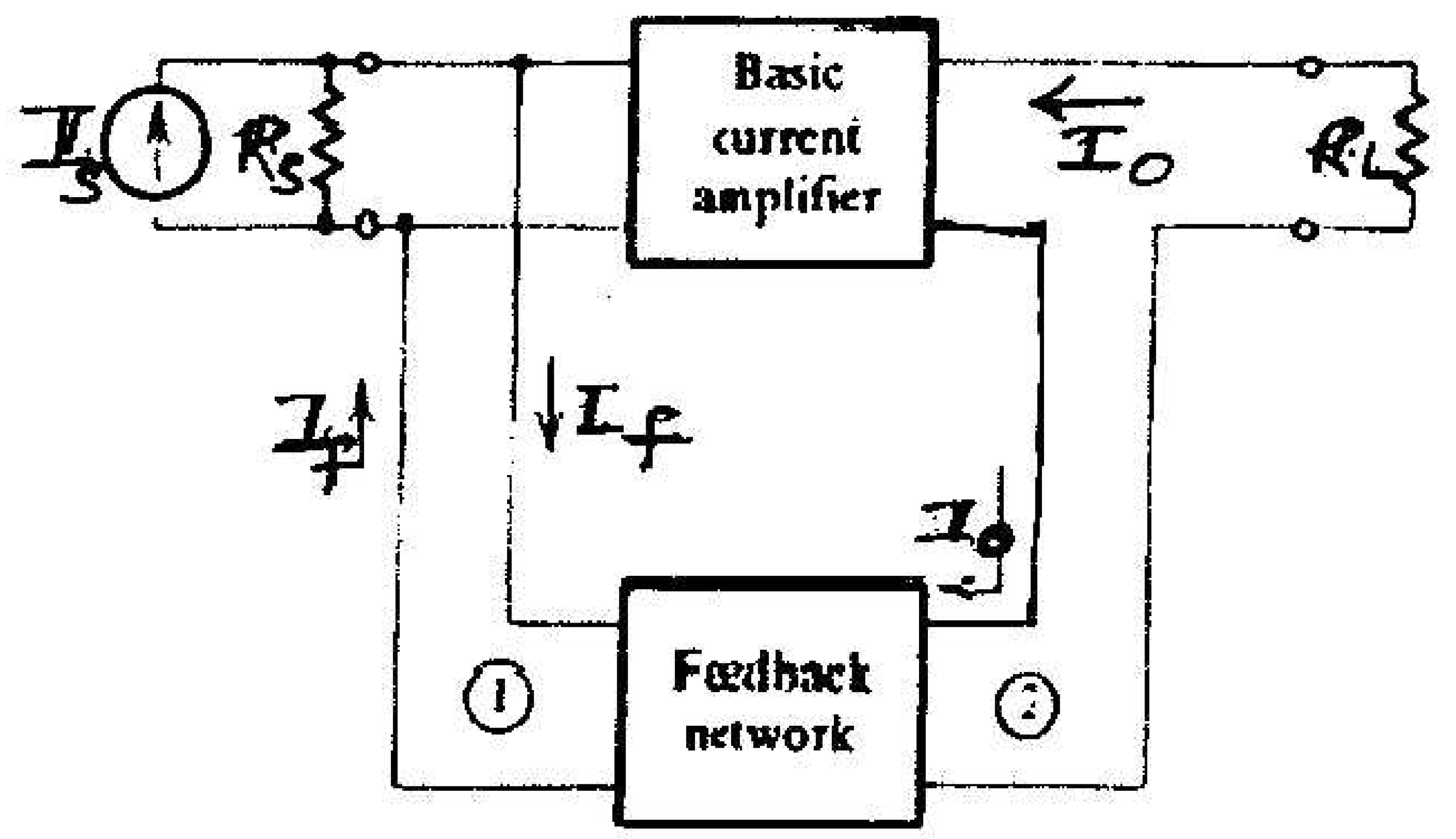


Fig.2

4. For the circuit shown in Fig.3, **derive** an expression for input resistance with feedback. (2 Marks)

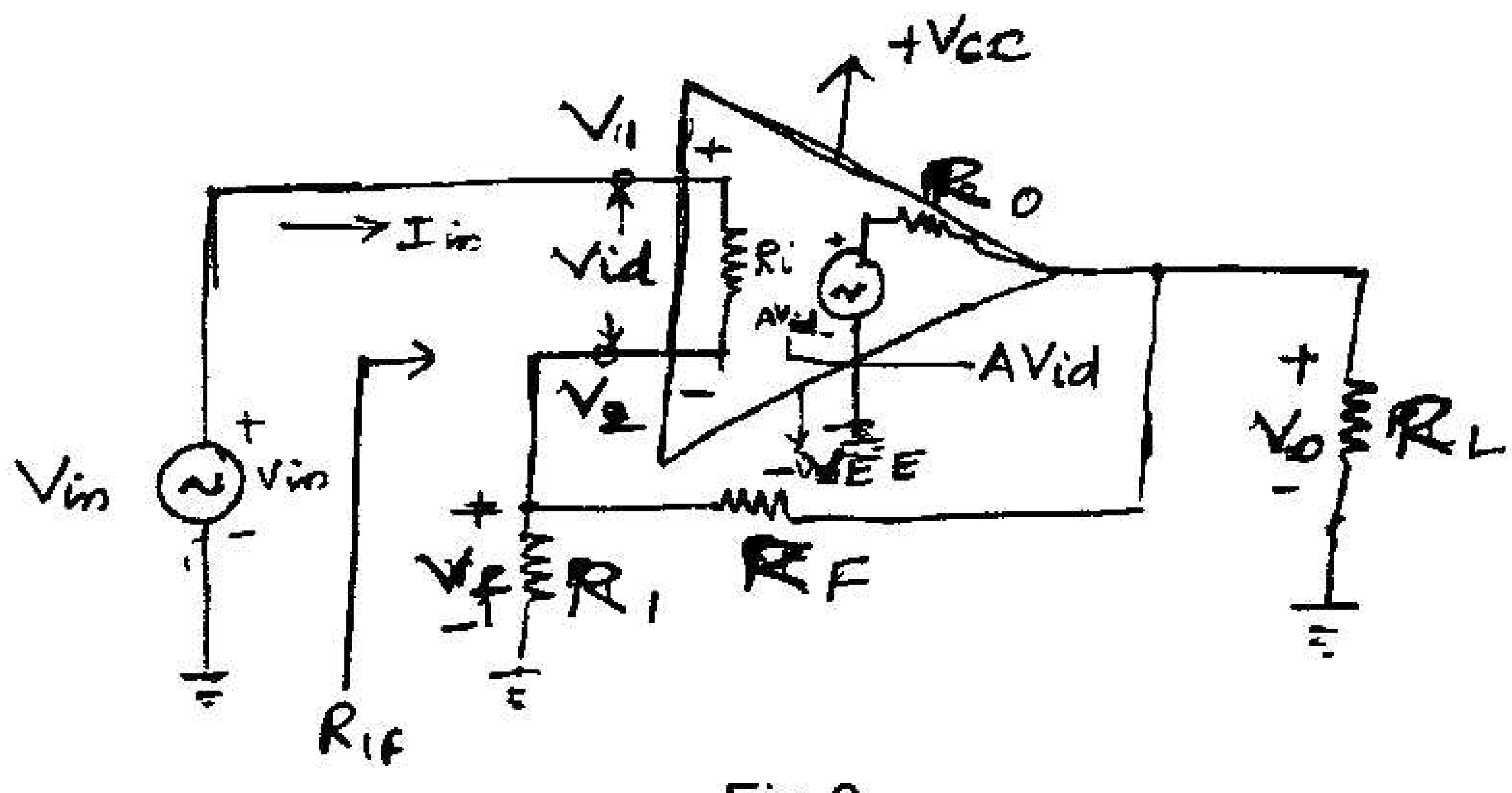


Fig.3

5. Draw the circuit of instrumentation amplifier and write down the expression for output voltage. (2Marks)