BITS, PILANI – DUBAI CAMPUS	
FIRST SEMESTER 2011 – 2012	
Course Code: EEE C364	Date: 11.1.2012
Course Title: Analog Electronics	Max Marks: 70
Duration: 3 Hours (8.30A.M – 11.30A.M)	Weightage: 35%
Component: COMPREHENSIVE EXAM (CLOSED BOOK)	
Note: This question paper contains 7 questions and 4 pages. Answer all Questions. Assume suitable data if required.	

Q1(a) Draw the circuit using OP-AMPS to implement the following expression: [4M]

$$V_o = V_1 + V_2 - [\, V_3 + V_4 + 2 \,]$$

(b) In the OPAMP circuit shown in Figure 1, it is desired that

$$V_0 = \frac{V_2}{3} - 2v_1$$

Find the value of R to achieve V_o. Suppose $V_1 = -10V$ and $V_2 = 10V$, find the magnitude of the current through all the resistors and power dissipated by the resistors. [6M]

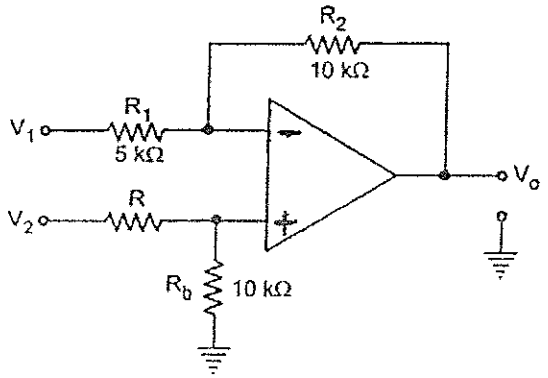
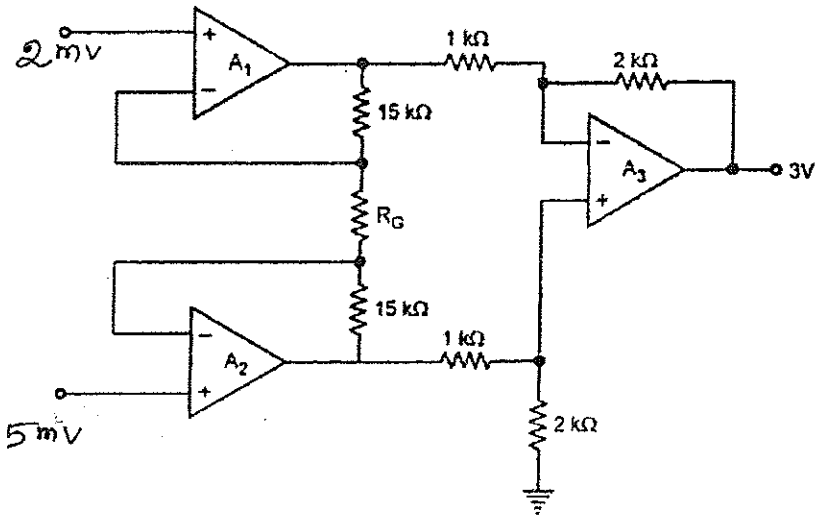
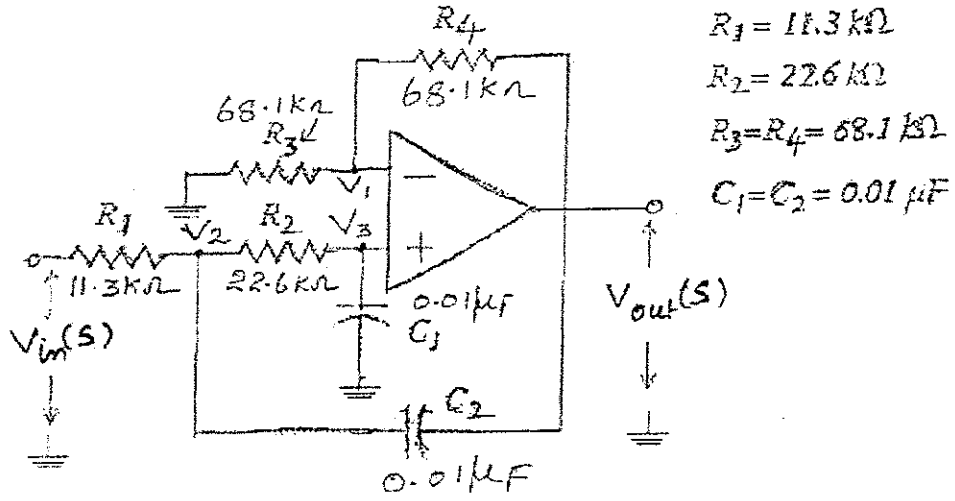
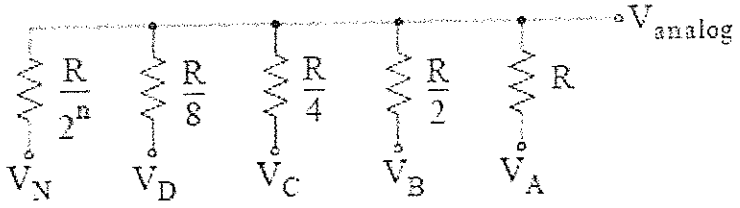


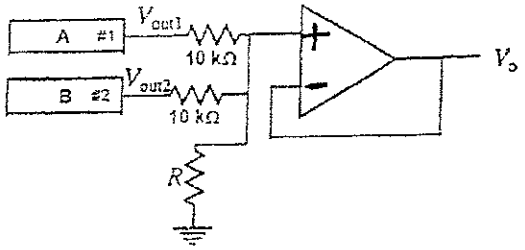
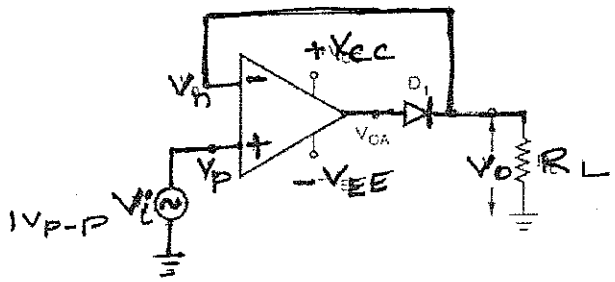
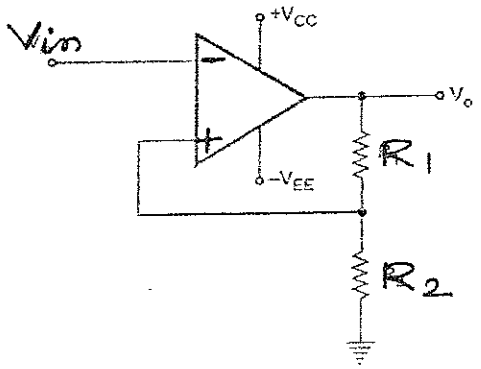
Figure 1

Q2(a) Realize log and antilog amplifiers using opamp, transistor and resistors. Show how log and antilog amplifiers can be used as a building block to obtain an output waveform $y = a^b$ where a and b are independent input waveforms. [3M]

(b) 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.(write only key points in your answer). [3M]

(C)	What application does the circuit shown in Figure 2 have? For the circuit shown in Figure 2, find the suitable value of R_G to provide an output of 3V.  Figure 2.	[4M]
Q3(a)	What is the need for current limiting in regulated power supplies? Write only key points in your answer.	[2M]
(b)	Design a low voltage regulator using IC723 with 5V output. Consider $I_L(max) = I_{sc}$ =100mA,Vsense = 0.7V,V_{ref} =7.15 V and R_1 =5kΩ. Draw the complete circuit diagram and determine the component values of other resistors. Assume suitable values of capacitors in picofarads and supply voltage of 10V.	[5M]
(C)	A Phase Locked Loop has free running frequency of 500KHZ and bandwidth of the low pass filter is 10KHZ. Will the loop acquire lock for an input signal of 600KHZ? Justify your answer. Assume that the phase detector produces sum and difference frequency components.	[3M]
Q4(a)	Draw a schematic of an op amp based RC phase shift oscillator. The phase shifting network is made of 3 identical RC sections. The op amp has a maximum input bias current of I_b = 50nA.Assume that a maximum current through the feedback resistor R_f is equal to $100I_b$ and the supply voltage for the op amp is ± 12 V. Design the oscillator circuit for an output frequency of 800HZ. Determine all component values required.	[4M]
(b)	Design an IC555 timer circuit such that a control door is set to open for duration of 10 seconds after a trigger signal is received. The dc voltage available for the IC is 15 V. Assume charging capacitor value as 10μF and filter capacitor as 0.01μF in your design. Draw the complete circuit diagram and determine all external component values used. Modify the above circuit such that the 10seconds opening of the door is repeated after every 5 seconds. Determine the values of any additional components used.	[6M]

Q5(a)	Derive the transfer function $\frac{V_{out}(S)}{V_{in}(S)}$ for the network shown in Figure 3.  Figure 3	[6M]
(b)	In Class A power amplifier, the total collector current is given by $i_C = (2.3)(2 + V_{in})^3$ where the input V_{in} (in mV) = 10sinωt. Determine the quiescent collector current, average collector current and the total harmonic distortion for the above power amplifier. Given $sin3\theta = 3sin\theta - 4sin^3\theta$.	[4M]
Q6(a)	Figure 4 shows a digital to analog converter with binary weighted resistors.  Figure 4 Derive an expression for V_{analog}	[4M]
(b)	Explain in brief the advantages of using IC temperature sensors. Write only key points in your answer.	[3M]

(C)	Two IC temperature sensors A and B deliver outputs 12 mV/° C and 14 mV/° C respectively. The outputs of these sensors are used as inputs to a non-inverting OPAMP as shown in Figure 5. The resistor R is of Unknown value. When the room temperature is 20° C the output V_o reads 20mV. Determine the value of R.  Figure 5	[3M]
Q7(a)	Identify the following circuit shown in Figure 6 and analyze its output voltage When $V_i > 0$ V and when $V_i < 0$ V. Draw the necessary circuit diagrams for $V_i > 0$ V and $V_i < 0$ V and sketch the input and out waveforms  Figure 6	[6M]
(b)	For the Schmitt trigger circuit shown in Figure 7, calculate the value of R_1 if saturation voltages are +12 V and -12 V. Assume hysteresis width as 6 V and R_2 =10kΩ  Figure 7	[4M]

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EEE C364 ANALOG ELECTRONICS - Test 2

Sem1, 2011 - 12 OPEN BOOK Time Allowed: 50 mins

Total Marks : 30 Weightage: 15%

INSTRUCTIONS

This paper contains **FIVE (5)** questions and 2 pages.Answer **ALL** questions.Assume suitable data if required. Semilog graph sheet is provided along with question paper.

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1. For the circuit shown in Fig.1, determine the lower cut-off frequency and then plot the frequency response of the filter by expressing gain in decibels. Comment on the order of the filter from the frequency response. [10M]

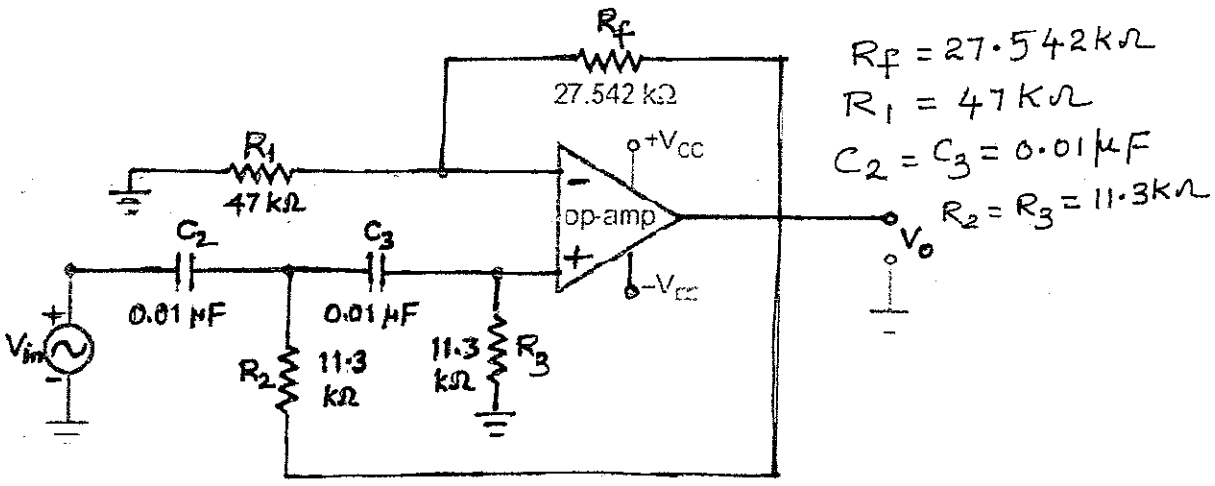

Fig.1

2. Draw the circuit diagram of IC 555 timer used as an astable mode to generate square wave of 1KHZ frequency, giving output equal to 5 V for 0.5msec and output equal to 0 V for next 0.5msec. Connect one red LED and one green LED so that for 0.5 msec red LED is ON and green LED is OFF and for next 0.5msec green LED is ON and red LED is OFF. LEDs (Light Emitting Diode) have ratings of 5 V and 50mA. Design the circuit for the above specifications. Assume Vcc = 5 V, V_{LED} = 0.7 V and C=0.1μF. [7M]

P.T.O

3. Draw the circuit diagram of IC 723 based positive voltage regulator to give +8 V output at 200mA. Incorporate short circuit protection current limit circuit to operate at 400mA. Find all resistor values calculate their wattage and specify the type of resistors. Assume C = 500PF, V_{ref} =7V and R_1 = 1kΩ in your design. [5M]

4. A Phase Locked Loop circuit using IC 565 is shown in Fig.2. Find the values of R_1 and C_2 for the following specifications: Free running frequency is 4.3 KHZ , lock range is 2.5 KHZ, Capture range is 100 HZ and supply voltage is ± 10 V.

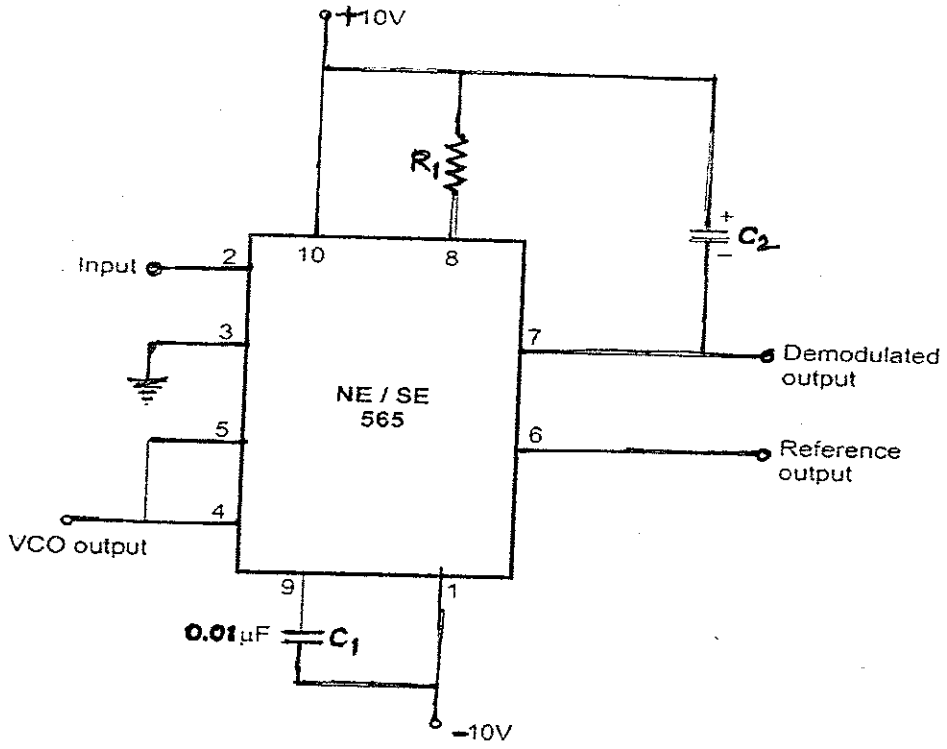

Fig.2

[4M]

5. Explain briefly what the Barkhausen criterion is for an oscillator circuit? How will the oscillator's circuit performance be affected if the Barkhausen criterion falls below 1 or goes much above 1? [4M]

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EEE C364 ANALOG ELECTRONICS - Test 1

Sem1, 2011 - 12 CLOSED BOOK Time Allowed: 50 mins

Total Marks : 30 Weightage: 15%

INSTRUCTIONS

This paper contains **six (6)** questions and 2 pages.Answer **ALL** questions.Assume suitable data if required.

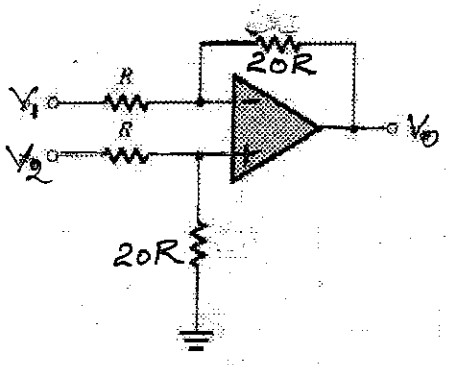
1. A common emitter npn transistor amplifier has $\beta = 100$. The collector terminal is connected to a 10V power supply through a resistance $R_C = 5K\Omega$. A dc bias of 1V is applied to the base terminal through a resistance $R_B = 2k\Omega$ and the emitter terminal is connected to the ground through an emitter resistor $1K\Omega$. The transistor is in the active mode of operation. Assume $V_{BE} = 0.7V$. Determine I_B, I_c, V_{CE}, V_B and V_C . (5 Marks)

2. An amplifier has open loop gain A = 60dB and output impedance $Z_0 = 10\ k\Omega$.A negative feedback when provided to this amplifier, modifies its output impedance to $Z_{of} = 500\Omega$. Determine the feedback factor. (5 Marks)

3. Draw the circuit using op amps by adding a voltage buffer to the front end of the inverting operational amplifier. What possible benefit is there by adding a voltage buffer to the front end of an inverting operational amplifier? Write only key points. (5 Marks)

4. Design the circuit using op amps to get an output
$$V_o = 5V_1 + 4V_2 - 2V_3$$
for three inputs $+V_1$, $+V_2$ and $+V_3$. (5 Marks)

5. For the circuit shown in Fig.1, use superposition to find V_o in terms of input voltages V_1 and V_2. Assume an ideal op amp.
For $V_1 = 10\sin(2\pi \times 60t) - 0.1\sin(2\pi \times 1000t)$, volts and
$V_2 = 10\sin(2\pi \times 60t) + 0.1\sin(2\pi \times 1000t)$, volts, find V_o.

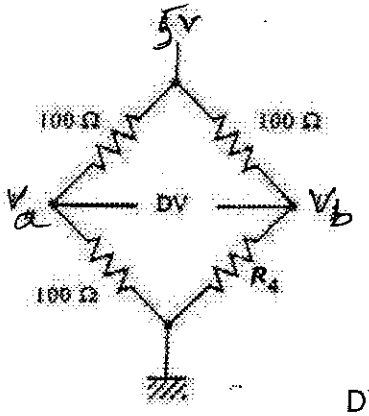


(5 Marks)

Fig.1

P.T.O

6. Fig.2 shows a bridge circuit for which R_4 varies with **100Ω to 102Ω**. Show that how an instrumentation amplifier like that in Fig.3 could be used to provide an output of **2.5V**. Assume that $R_2=R_3=1k\Omega$ and that $R_1=100k\Omega$.Draw the circuit diagram that contains bridge circuit and an instrumentation amplifier and find the value of R_G. (5Marks)



DV – Differential Voltage

Fig.2

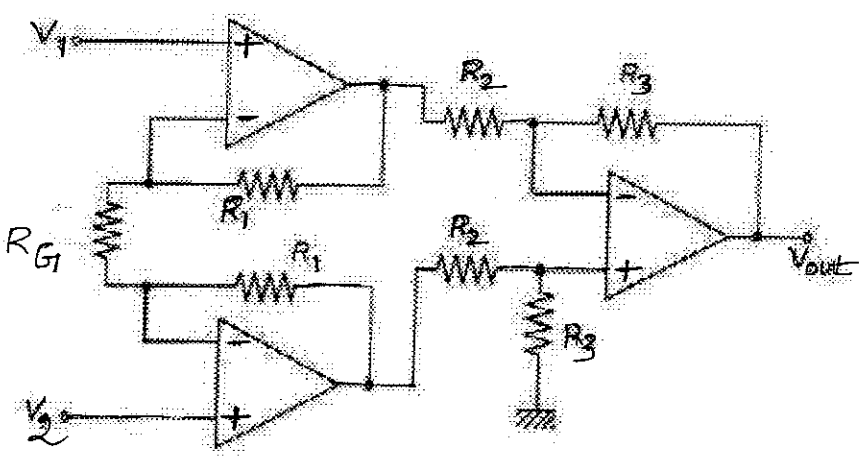


Fig.3

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EEE C364 ANALOG ELECTRONICS - Quiz 2 **SET A**

Sem1, 2011 - 12 CLOSED BOOK Time Allowed: 20 mins

Total Marks : 10 Weightage: 5%

Name of the Student: ID Number:

Instructions: This question paper has 5 Questions. Answer all Questions. Write the answers in the blank space provided after each question. You may use the reverse side if necessary.

1. Determine the output voltage of the following circuit (Fig.1), assuming a silicon diode of 0.7 volts typical forward drop. [1M]

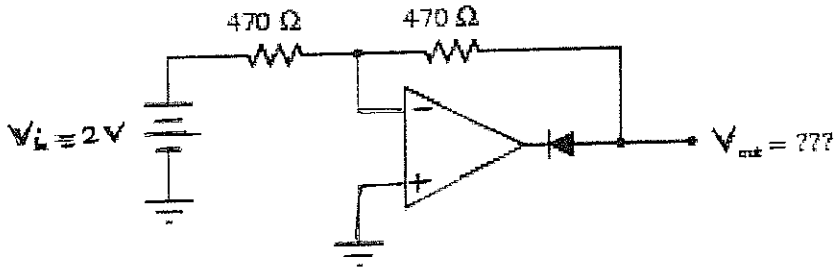

Fig.1

2. Identify the circuit in Fig.2, and analyze its output voltage when $V_i > 0$ V and when $V_i < 0$ V. Assume $R_f=R_1=1k\Omega$. Sketch the input and output waveforms.

[2M]

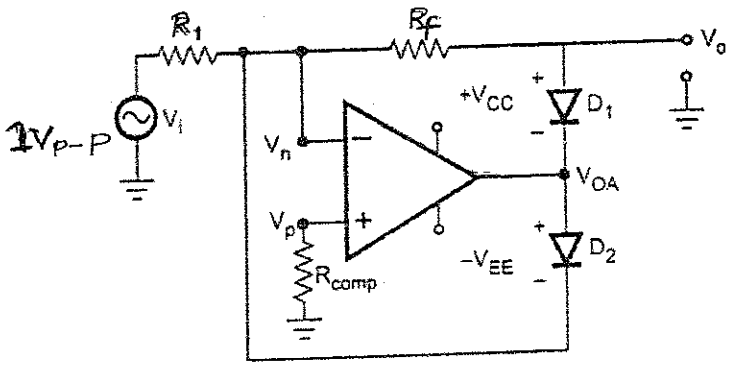

Fig. 2

3. What is the advantage of active op-amp based clipper over passive clipper circuits? Write only key points in your answer. [2M]

4. For the schmitt trigger circuit shown in Fig.3, Calculate the upper and lower threshold voltage levels and hysteresis voltage. Assume Vsat = 0.9 Vcc.

[3M]

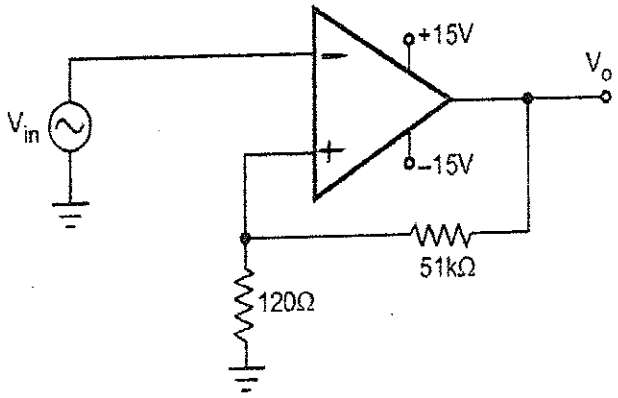

Fig.3

5. Using op amps 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. [2M]

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EEE C364 ANALOG ELECTRONICS QUIZ-1(CLOSED BOOK)

WEIGHTAGE: 5%, DATE: 28.9.2011, DURATION: 20 MINUTES

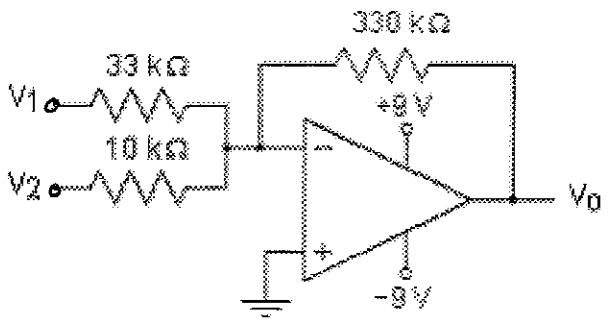
MAX MARKS: 10MARKS

Name: ---------- ID: ----------

(SET A)

This question paper has 3 pages and 8 questions .Answer all Questions

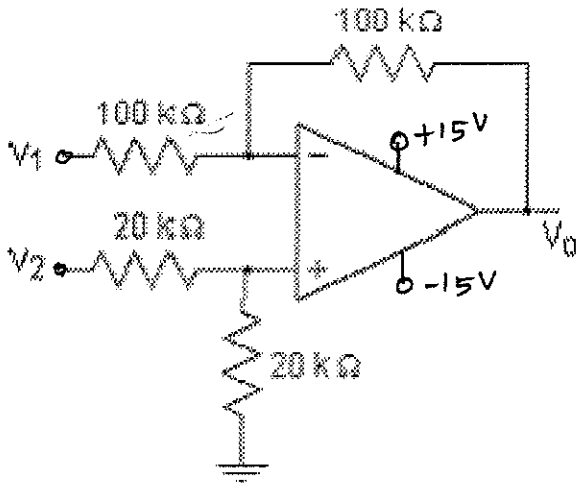
1. For the circuit shown below, Calculate the output voltage if $V_1 = -0.2$ V and $V_2 = 0$ V . [1M]



2. Sketch the transfer characteristic of Operational amplifier. [2M]

3. Determine the output voltage when $V_1 = -V_2 = 1$ V for the circuit shown below.

[1M]



4. The characteristics of an ideal op amp does not include [1M]

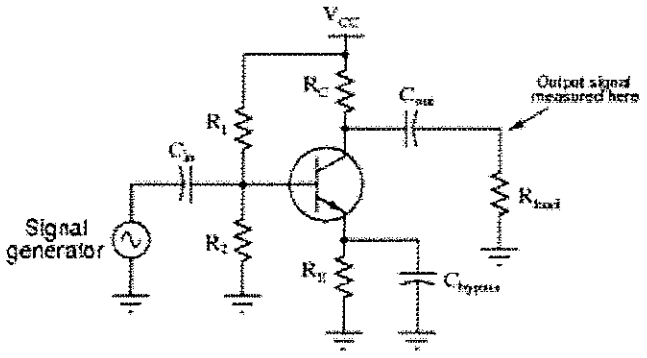
A) Infinite voltage gain
B) Infinite input impedance
C) Infinite output impedance and
D) Infinite CMRR

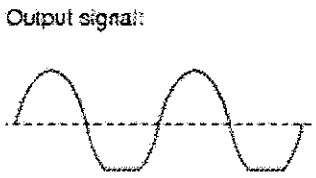
Ans:----------

5. What type of feedback is used to stabilize the overall voltage gain of the inverting op amp circuit? [1M]

6. One of the most important parameters for semiconductor components is the *power rating*. Explain why power rating is such a critical parameter, especially compared with other types of electronic components (resistors, inductors, capacitors, etc.).Write only key points in your answer. [1M]

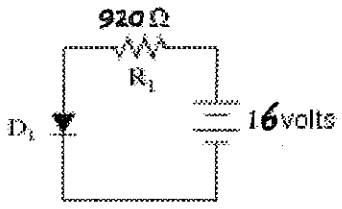
7. Suppose you were troubleshooting the following amplifier circuit, and found the output signal to be "clipped" on the negative peaks:





If you knew that this amplifier was a new design, and might not have all its components properly sized, what type of problem would you suspect in the above circuit? Give your answer as specific as possible. [1M]

8. Complete the following table of values for this diode circuit, assuming a typical forward voltage drop of 0.72 volts for the diode [2M]



	R_1	D_1	Total
V			16 V
I			
R	920 Ω		
P			