Roll No.:.....

National Institute of Technology, Delhi

Name of the Examination: B. Tech.

Branch	**: ECE & EEE**	**Semester**	**: V**
Title of the Course	**: IC Applications**	**Course Code**	**: ECB 304**
Time: 3 Hours		**Maximum Marks: 50**	

SECTION A

Attempt all the questions **1*10=10**

1. Recognize the circuit given in Fig. 1. If the input to the circuit is a sine wave, then sketch the output waveform?

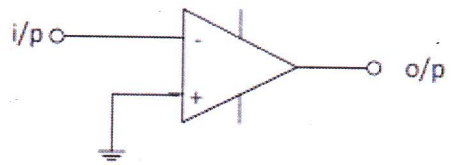

Fig. 1

2. Since negative feedback in an amplifier reduces transfer gain, then why is it used?
3. State the Barkhausian criterion for the operation of sinusoidal oscillator.
4. Define input bias current and input offset current of a practical op-amp.
5. What happens to the input and output impedance in a voltage series negative feedback amplifier?
6. Write down the frequency of oscillation in an op-amp phase shift oscillator. What will happen if the magnitude of the product of transfer gain of a sinusoidal oscillator is less than unity?
7. How and by what amount is the quality factor of a second order low pass Butterworth filter improved over its counterpart passive filter?
8. Determine the lower frequency limit of integration for the circuit shown in Fig. 2

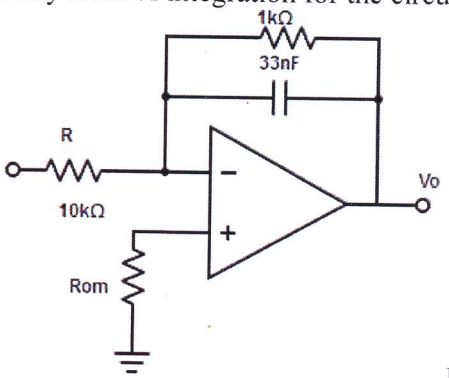

Fig. 2

9. Determine the output current for the circuit shown in Fig. 3

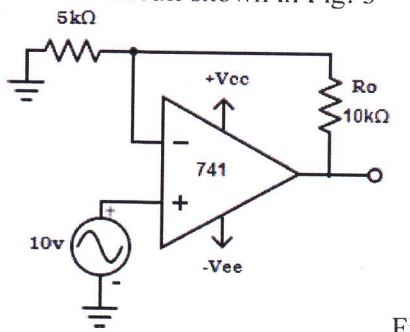

Fig. 3

10. Draw the voltage transfer curve of an ideal op-amp.

SECTION B

Attempt any four questions

11. Define CMRR. In the figure shown in Fig 4, if the CMRR of the operational amplifier is 60 dB, then the magnitude of the output voltage is? [5 Marks]

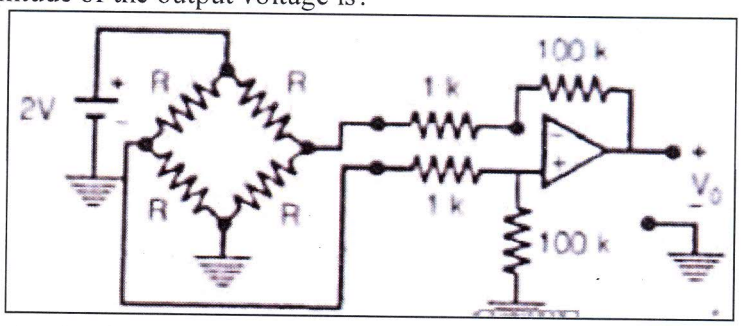

Fig. 4

12. Draw the circuit of a square wave generator and derive an expression for the total time period of the output waveform. Also calculate its duty cycle. [5 Marks]
13. (a) Explain a positive DC inserter and sketch the output waveform if a sinusoidal waveform is given at its input. [3 marks]
    (b) If the op-amp in the circuit shown in Fig. 5 is ideal, then calculate its output voltage. [2 marks]

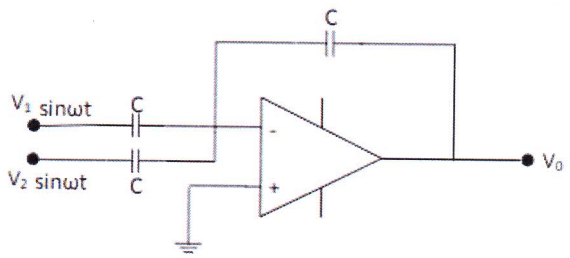

Fig. 5

14. (a) Draw the circuit of a voltage limiter and explain its working. [2 marks]
    (b) Determine the value of f_o and β from the circuit diagram shown in Fig. 6. [3 marks]

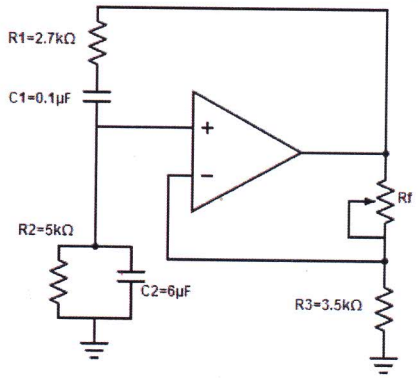

Fig. 6

15. For the dual input balanced-output differential amplifier shown in Fig. 7, $R_{C1} = R_{C2} = 2.2\ k\Omega$, $R_{s1} = R_{s2} = 50\ \Omega$, $R_E = 4.7\ k\Omega$, $+V_{CC} = 10V$, $-V_{EE} = -10\ V$, $\beta_{dc} = 100$ and $V_{BE} = 0.715V$. Determine the operating points (I_{CQ} and V_{CEQ}) of the two transistors. [5 marks]

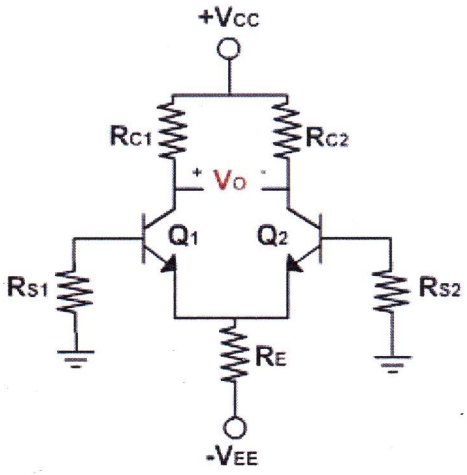

Fig. 7

SECTION C

Attempt any two questions

16. (a) Calculate the total output offset voltage for a non-inverting amplifier with negative feedback. Also design an offset voltage compensating network for the same. [6 marks]

(b). What is a zero crossing detector? If the maximum output available from an op-amp used as a zero crossing detector is ±12 V_{p-p} and slew rate of the op-amp is 12V/μsec, then calculate the maximum frequency of the input signal that can be applied without causing a reduction in the p-p output voltage. [4 marks]

17. (a) Draw the circuit of a first order Low pass Butterworth filter and derive an expression for a maximally flat response in the pass band. Also draw its frequency response. [5 marks]

(b) Which circuit is used for providing phase compensation in a network? Calculate its gain and draw the necessary waveforms. [4 marks]

(c) A band-pass filter has a bandwidth of 250Hz and center frequency of 866Hz. Find the quality factor of the filter? [1 mark]

18. (a). Explain the working of a Schmitt Trigger and draw the hysteresis loop. [5 marks]

(b) For the circuit shown in Fig. 8, V_I = 500mV peak sine wave at 100Hz, R = 100Ω and V_{ZI} = 6.2V, V_D = 0.7V. The op-amp 741 is driven by a supply of ±15V. Draw the output waveform and determine the output voltage swing. [5 marks]

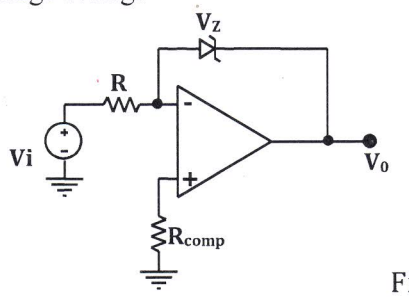

Fig. 8