Total number of printed pages: **3** **Programme(UG)/4th/UIE401**

2023

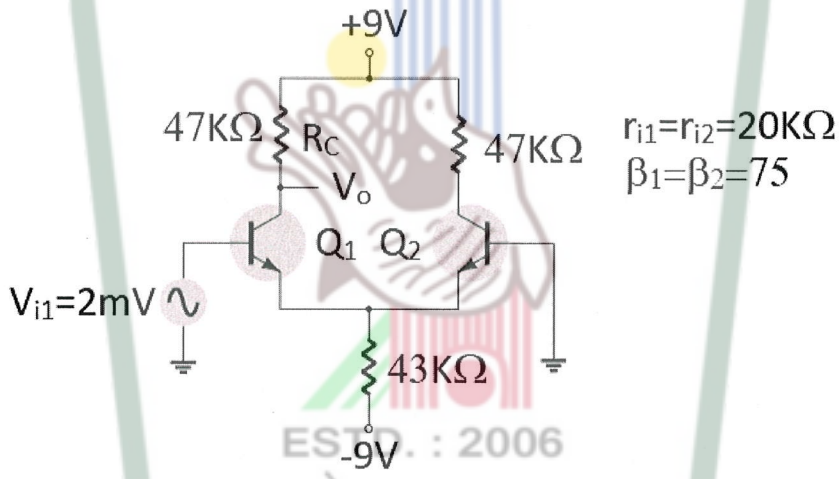
ANALOG INTEGRATED CIRCUITS

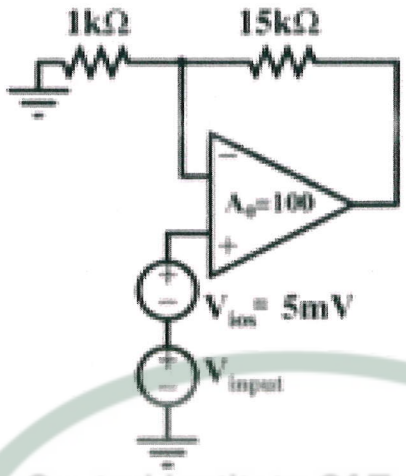
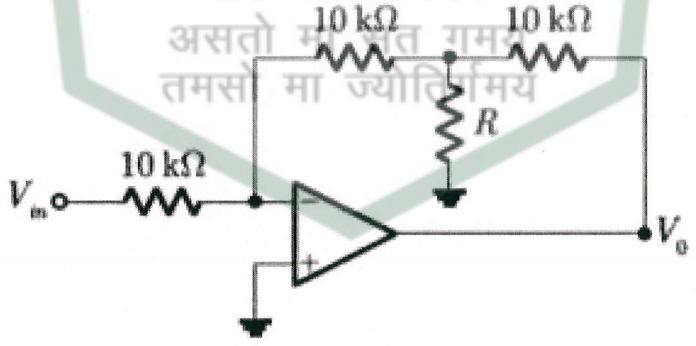
Full Marks : 100

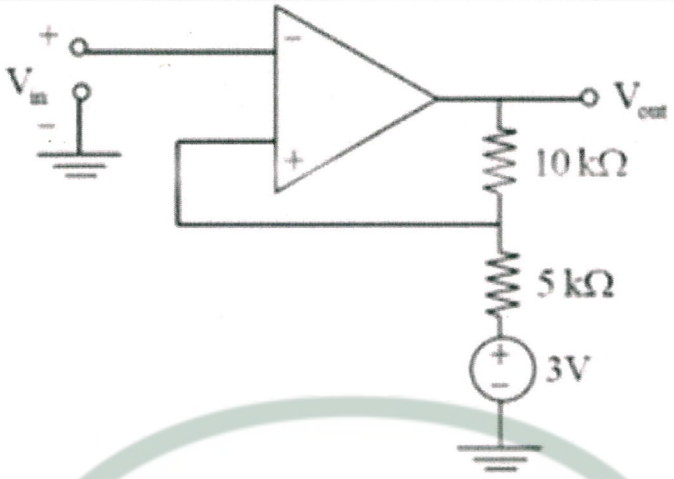
Time : Three hours

The figures in the margin indicate full marks for the questions.

*Answer **any five** questions.*

1.	a)	Calculate the single-ended output voltage V_{o1} and Common mode gain for the circuit of Fig.1.  Fig.1	6
	b)	Draw the AC and ideal equivalent circuit of an OpAmp as a constant gain multiplier. Also derive the expression for gain.	4+6=10
	c)	Determine the output of an inverting amplifier and a non-inverting amplifier if R_1=100KΩ, R_f=500 KΩ, and V_1=2V.	4
2.	a)	Calculate the output voltage of an op-amp summing amplifier for the following sets of voltages and resistors. Use R_f = 1 M in all cases. a. V_1 = +1 V, V_2 = +2 V, V_3 = +3 V, R_1 = 500 k, R_2 = 1 M, R_3 = 1 M. b. V_1 = -2 V, V_2 = +3 V, V_3 = +1 V, R_1 = 200 k, R_2 = 500 k, R_3 = 1 M	5
	b)	An OpAmp has a finite open loop gain of 100. Its input offset voltage V_{ios}(=+5mV) is modeled as shown in Fig. 2. The amplifier is ideal in all other respects. V_{input} is 25mV. Determine the output voltage.	5

		 Fig. 2	
	c)	Derive expressions for output voltage of an integrator and a differentiator using OpAmp.	10
3.	a)	Derive the expression for output voltage of an OpAmp in terms of A_d, V_d, V_c and CMRR.	10
	b)	Determine the output voltage of an op-amp for input voltages of V_{i1} = 150 mV and V_{i2} = 140 mV. The amplifier has a differential gain of A_d =4000 and the value of CMRR is: i. 100. ii. 10^5 .	5
	c)	In the circuit of Fig. 3 assume that the OpAmp is ideal. If the gain V_o/V_{in} is -12 determine the value of R in kΩ.  Fig. 3	5
4.	a)	Derive the output of log and antilog amplifier.	10
	b)	For the OpAmp circuit shown the output saturation voltage is ±15V. Determine the upper and lower threshold voltages of the circuit.	6

		 Fig. 4	
	c)	What is precision rectifier ? Explain.	4
5.	a)	What are the different types of controlled sources using OpAmp. Explain each type.	10
	b)	Explain the working of an astable multivibrator using NE555 timer.	5
	c)	How triangular wave can be generated? Explain.	5
6.	Write short notes on any two of the following		10x2=20
	a)	Wein Bridge oscillator	
	b)	Instrumentation Amplifier	
	c)	Schmitt Trigger	