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C.) Input Offset current (I_{io}):

(19) Calculate Input Offset current (I_{io}) = $I_{B1} - I_{B2}$

DC parameters values from datasheet

Parameters	LM741	OP 07	LF356
Input Offset Voltage (V_{io})	2 mV To 6mV	60 μV To 150 μV	3mV To 13mV
Input bias current (I_B)	80 nA To 500nA	2.2nA To 14nA	8nA
Input offset current (I_{io})	20nA To 200nA	1.6nA To 8nA	2nA

⇒ Observation Table :

Parameters	LM741	OP 07	LF 356
V_o	1130 mV	120mV	750 mV
V_{io}	1.12mV	0.119 mV	749 mV
I_{B1}	23.6nA	20.1 nA	11.0 nA
I_{B2}	23.5nA	19.9 nA	17 nA
I_B	23.55nA	20	14nA
I_{io}	0.1 nA	0.1	9.3 nA

⇒ Conclusion:

Hence, we learnt measurement of DC parameters of OP Amp. To measure input bias current, input offset current and input offset voltage. To compare the result with datasheet of corresponding Op Amp.

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Observation Table :

Vin = 1 Vpp

I/P Freq (KHz)	O/P Voltage (V_o)	Gain (V_o/Vin)	Gain (dB) ($20\log_{10} V_o/V_{in}$)	I/P Freq (KHz)	O/P Voltage (V_o)	Gain (V_o/Vin)	Gain (dB) ($20\log_{10} V_o/V_{in}$)
500Hz	9.20	9.2	19.27	6	2.6	2.6	8.3
1.0	8.00	8	18.06	7	2.2	2.2	6.84
1.1	7.80	7.8	17.84	8	2	2	6.02
1.2	7.60	7.6	17.61	9	1.8	1.8	5.1
1.3	7.4	7.4	17.38	10	1.6	1.6	4.08
1.4	7.2	7.2	17.14	11	1.4	1.4	2.92
1.5	7.0	7	16.90	12	1.2	1.2	1.58
1.6	6.8	6.8	16.65	13	1.2	1.2	1.58
1.7	6.4	6.4	16.12	14	1.2	1.2	1.58
1.8	6.4	6.4	16.12	15	1.2	1.2	1.58
1.9	6	6	15.56	16	1.2	1.2	1.58
2	5.8	5.8	15.26	17	1.2	1.2	[illegible] 0
3	4.6	4.6	13.26	18	1.2	1.2	[illegible] 0
4	3.4	3.4	10.63	19	1.0	1.0	0
5	3	3	9.54	20	1.0	1	0

Result Table :

Frequency	Theoretically	Practically
fa	1.5 KHz	1.6 KHz
fb	15 KHz	19 KHz
AVmax	20 dB	19.27 dB

⇒ Conclusion :

Hence, we learnt to simulate op-amp bated integrators. Also, observed output waveforms for sine and square wave input and plotted frequency response for integrator

(2) Give a sinusoidal input of $100mV_{pp}$, 1KHz from a signal generator.
(3) Switch on the power supply and note down the output from CRO
(4) Repeat the above procedure by reversing the diodes
(5) Measure the output voltage for positive and negative half cycle
(6) Draw the input and output waveforms for each circuit

⇒ Observation Table :

$V_{in} = 100\ mV_{pp}$

Rectifier Type	Output Voltage (V_o)	
	For +ve half cycle	For -ve half cycle
Non-Inverting Half wave precision rectifier	50 mV	50 mV
Inverting half wave precision rectifier	50 mV	0
Full-wave precision rectifier	0	+50 mV

⇒ Conclusion :
Hence, we learnt to simulate precision rectifier for given specifications, to understand the concept of superdiode, to implement inverting and non-inverting half wave rectifier, to implement inverting and non-inverting full wave rectifier and and output waveform

⇒ Procedure: (1) Connect the circuit as shown
(2) Switch on the dual power supply and observe output on the CRO
(3) Measure the charging and discharging voltage across the capacitor.
(4) Compare the practical results with theoretical values
(5) Build the triangular wave generator using circuit diagram
(6) Compare the practical results with theoretical values
(7) Draw the necessary waveforms

⇒ Observation Table: Square wave generator

Parameters	Theoretically	Practically
$+V_{sat}$	+10.8V	+10.8 V
$-V_{sat}$	−10.8 V	−10.8 V
$+\beta V_{sat}$	+4.97	+5 V
$-\beta V_{sat}$	−4.97	−5 V
f_a	1 KHz	0.9 KHz

Triangular Wave Generator

Parameters	Theoretically	Practically
$(V_o)_{PP}$	5.4 V_{PP}	—
Frequency	1 KHz	—

⇒ Conclusion: Hence, we learnt to design, build and test square wave and triangular wave generator. Also, design of square wave generator for given specification and calculate frequency of output waveform theoretically and practically.

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Parameters	Theoretical	Practical
Higher cutoff Frequency (FH)	1 KHz	1.003 KHz
Lower cutoff Frequency (FL)	1 KHz	0.998 KHz

⇒ Conclusion :

Hence, we learnt to design and simulate first order low pass and high pass filter.

Also to design a low pass filter at cutoff frequency of 1 KHz with a pass band gain of 2. and design a high pass filter at cut off frequency of 1 KHz with a pass band gain of 2.