12. VOLTAGE REGULATOR USING OP-AMP

AIM:

To design a high current, low voltage and high voltage linear variable dc regulated power supply and test its line and load regulation.

APPARATUS REQUIRED:

S.NO	APPARATUS	SPECIFICATION	QUANTITY
1.	Transistors	TIP122,2N3055	1 each
2.	Integrated Circuit	LM723	1
3.	Digital Ammeter	(0 – 10) A	1
4.	Digital Voltmeter	(0 – 20) V	1
5.	Variable Power Supply	(0 – 30) V-2A	1
6.	Resistors	300Ω ,430Ω ,1KΩ ,678KΩ ,67 8Ω 1Ω	1 each 2
7.	Capacitors	0.1µ F,100pF	1 each
8.	Rheostat	(0 – 350) Ω	1

THEORY:

A voltage regulator is an electrical regulator designed to automatically maintain a constant voltage level. A voltage regulator may be a simple "feed-forward" design or may include negative feedback control loops. It may use an electromechanical mechanism, or electronic components. Depending on the design, it may be used to regulate one or more AC or DC voltages. Load regulation is the change in output voltage for a given change in load current. Line regulation or input regulation is the degree to which output voltage changes with input (supply) voltage changes - as a ratio of output to input change. Active regulators employ at least one active (amplifying) component such as a transistor or operational amplifier. linear regulator is a voltage regulator based on an active device (such as a bipolar junction transistor, field effect transistor or vacuum tube) operating in its "linear region"

PROCEDURE:

Line Regulation:

1. Give the circuit connection as per the circuit diagram
2. Set the load Resistance to give load current of 0.25A
3. Vary the input voltage from 7V to 18V and note down the corresponding output voltages
4. Similarly set the load current (I_L) to 0.5A & 0.9A and make two more sets of measurements.

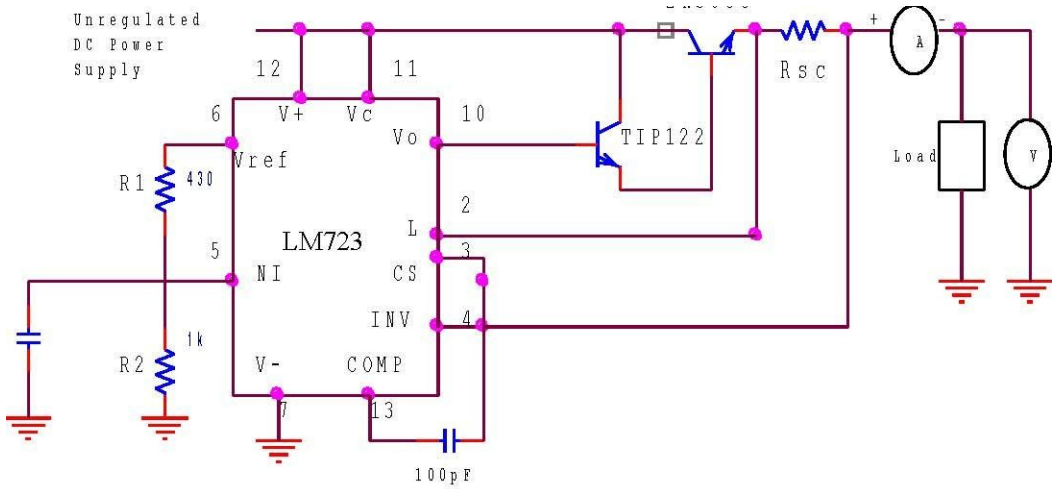
Load Regulation:

1 Set the input voltage to 10V.

2 Vary the load resistance in equal steps from 350Ω to 5Ω and note down the corresponding output voltage and load current.

3 Similarly set the input voltage (Vin) to 14V & 18V and make two more sets of measurements.

CIRCUIT DIAGRAM:



DESIGN:

Vo=5V, Vref = 7.15 V

To calculate R1, R2 ,R3 and Rsc.
Vo = Vref (R2 / (R1 + R2))

5 / 7.15 = (R2 / (R1 + R2))

(R1 + R2) 0.699= R2

0.699R1 = 0.301 R2 , R1 = 0.4306 R2

Select **R2 = 1 KΩ**

R1 = 1 KΩ * 0.4306 = 430Ω

R1 = 430Ω

R3 = R1 * R2 / (R1 + R2) , R3 = 430.6 *1000 /(430.6+1000)

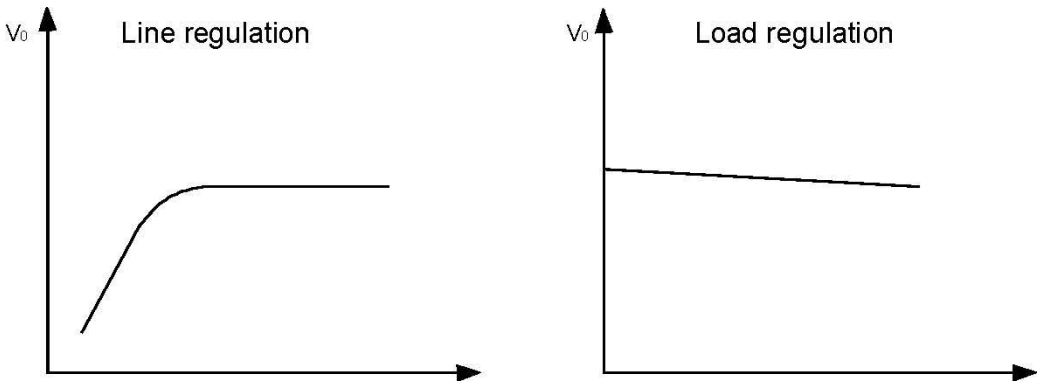
R3 = 300Ω
Rsc = V_{sense} / I_{limit} = 0.5 /1A = 0.5Ω , **Rsc = 0.5Ω**

Load Regulation:

S.No:	I/P Voltage (V)	O/P Voltage (V)
1)	1	5
2)	2	5
3)	3	5
4)	4	4.7
5)	5	4.7
6)	6	4.6

Line Regulation:

S.No:	I/P Voltage	
	O/P Current (mA)	O/P Voltage (V)
1)	1	1.5
2)	2	2.3
3)	3	3.1
4)	4	4.4
5)	5	4.9
6)	6	5
7)	7	5
8)	8	5



RESULT:

Thus the line and load regulation of low voltage linear variable dc regulated power supply was designed and tested.