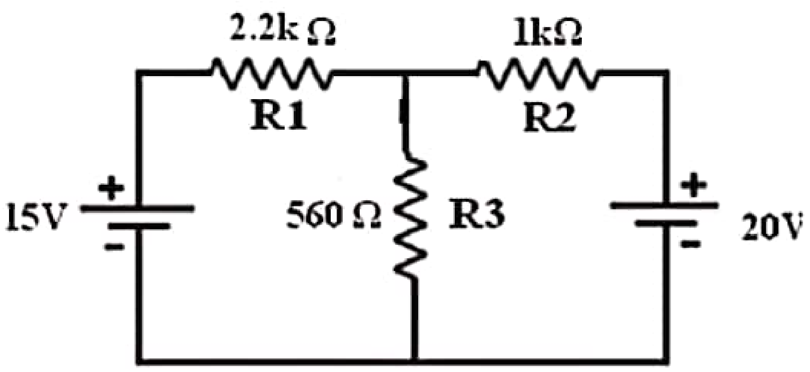
## 4. VERIFICATION OF SUPERPOSITION THEOREM

**AIM:** To verify the superposition theorem for the given circuit.

**APPARATUS REQUIRED:**

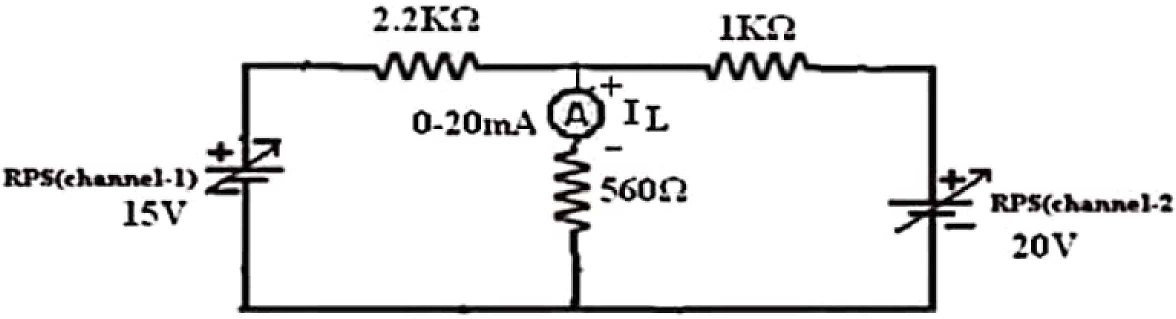
| S.No | Name Of The Equipment | Range | Type | Quantity |
|---|---|---|---|---|
| 1 | Bread board | - | - | 1 NO |
| 2 | Ammeter | (0-20) mA | Digital | 1 NO |
| 3 | RPS | 0-30V | Digital | 1 NO |
| 4 | Resistors | 2.2k Ω | | 1 NO |
| | | 1k Ω | | 1 NO |
| | | 560 Ω | | 1 NO |
| 5 | Connecting Wires | - | - | As required |

**CIRCUIT DIAGRAM:**




**PRACTICAL CIRCUITS:**

**When $V_1$ & $V_2$ source acting(To find $I_L$):-**




Fig(1)

**When $V_1$ Source Acting (To Find $I_L^I$)**

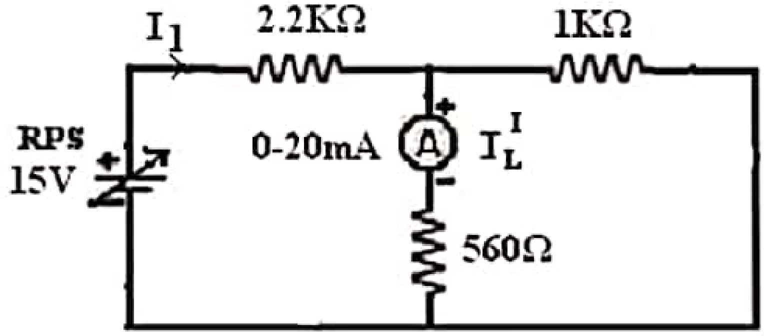



Fig (2)

**When$V_2$ source acting (To find $I_L^{II}$):**

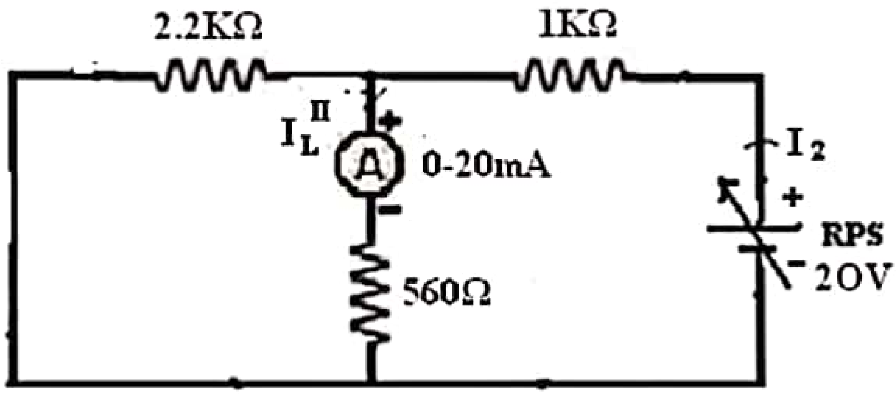



Fig (3)

## THEORY:

## SUPERPOSITION THEOREM:

Superposition theorem states that in a lumped ,linear, bilateral network consisting more number of sources each branch current(voltage) is the algebraic sum all currents ( branch voltages), each of which is determined by considering one source at a time and removing all other sources. In removing the sources, voltage and current sources are replaced by internal resistances.

## PROCEDURE:

1. Connect the circuit as per the fig (1).
2. Adjust the output voltage of sources X and Y to appropriate values (Say 15V and20V respectively).
3. Note down the current ($I_L$) through the 560 0hm resistor by using the ammeter.
4. Connect the circuit as per fig (2) and set the source Y (20V) to 0V.
5. Note down the current ( $I_L^{I)}$ through 560ohm resistor by using ammeter.
6. Connect the circuit as per fig(3) and set the source X (15V) to 0V and source Y to 20V.
7. Note down the current ($I_L^{II}$) through the 560 ohm resistor branch by using ammeter.
8. Reduce the output voltage of the sources X and Y to 0V and switch off the supply.
9. Disconnect the circuit.

## THEORITICAL CALCULATIONS

**From Fig(2)**

$$I_1=V_1/(R_1+(R_2//R_3))$$

$$I_L^{I}=I_1*R_2/(R_2+R_3)$$

**From Fig(3)**

$$I_2=V_2/(R_2+(R_1//R_3))$$

$$I_L^{II}=I_2*R_1/(R_1+R_3)$$

$$I_L=I_L^{I}+I_L^{II}$$

## TABULAR COLUMNS:

**From Fig(1)**

| S. No | Applied voltage ($V_1$) Volt | Applied voltage ($V_2$) Volt | Current $I_L$ (mA) |
|---|---|---|---|
| | | | |

**From Fig(2)**

| S. No | Applied voltage ($V_1$) Volt | Current $I_L^{I}$ (mA) |
|---|---|---|
| | | |

**From Fig(3)**

| S. No | Applied voltage ($V_2$) Volt | Current $I_L^{II}$ (mA) |
|---|---|---|
| | | |

| S.No | Load current | Theoretical Values | Practical Values |
|---|---|---|---|
| 1 | When Both sources are acting, $I_L$ | | |
| 2 | When only source X is acting, $I_L{}'$ | | |
| 3 | When only source Y is acting, $I_L{}''$ | | |

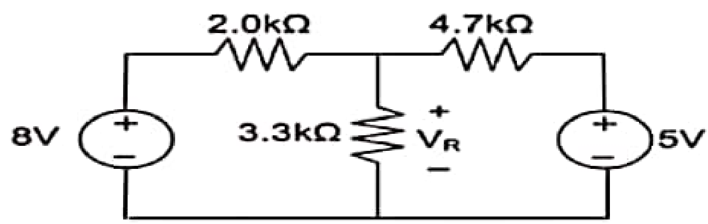
**PRECAUTIONS:**

1. Initially keep the RPS output voltage knob in zero volt position.
2. Set the ammeter pointer at zero position.
3. Take the readings without parallax error.
4. Avoid loose connections.
5. Avoid short circuit of RPS output terminals.

**RESULT:**

**EXERCISE QUESTIONS:**

1. Using the superposition theorem, determine the voltage drop and current across t resistor 3.3K as shown in figure below.




**VIVA QUESTIONS:**

1) What do you mean by Unilateral and Bilateral network? Give the limitations of Superposition Theorem?
2) What are the equivalent internal impedances for an ideal voltage source and for a Current source?
3) Transform a physical voltage source into its equivalent current source.
4) If all the 3 star connected impedance are identical and equal to ZA, then what is the Delta connected resistors