Experiment Title: Resistance Measurement and Verification

Objective

1. To identify the resistance values of given resistors using the color code.
2. To verify the resistance values using a multimeter.
3. To compare the measured values with the tolerance given in the color code.
4. To study the equivalent resistance in series and parallel combinations of two resistors.

Apparatus Required

- Resistors with color codes.
- Digital or analog multimeter.
- Connecting wires.
- Breadboard (optional).

Theory

Resistor Color Code

- Resistor values are identified using the color bands painted on their body.
- The resistance R is calculated as:

$$R = (AB \times 10^C)\,\Omega$$

  where:

  - A, B: Significant digits (Band 1 and Band 2).
  - C: Multiplier (Band 3).
  - Band 4 indicates the tolerance.

Resistor Color Code Chart

Color	Significant Digit (Bands 1 & 2)	Multiplier (Band 3)	Tolerance (Band 4)
Black	0	$10^0 = 1$	-
Brown	1	$10^1 = 10$	$\pm 1\%$
Red	2	$10^2 = 100$	$\pm 2\%$
Orange	3	$10^3 = 1{,}000$	-
Yellow	4	$10^4 = 10{,}000$	-
Green	5	$10^5 = 100{,}000$	$\pm 0.5\%$
Blue	6	$10^6 = 1{,}000{,}000$	$\pm 0.25\%$
Violet	7	$10^7 = 10{,}000{,}000$	$\pm 0.1\%$
Gray	8	$10^8 = 100{,}000{,}000$	$\pm 0.05\%$
White	9	$10^9 = 1{,}000{,}000{,}000$	-
Gold	-	$10^{-1} = 0.1$	$\pm 5\%$
Silver	-	$10^{-2} = 0.01$	$\pm 10\%$
None	-	-	$\pm 20\%$

Series and Parallel Resistance

1. **Series Resistance:**
$$R_s = R_1 + R_2$$
2. **Parallel Resistance:**
$$\frac{1}{R_p} = \frac{1}{R_1} + \frac{1}{R_2}$$

Procedure

Part A: Resistance Identification using Color Code

1. Observe the color bands on the resistor and note them.
2. Decode the resistance value and tolerance using the color code chart.

Part B: Verification using Multimeter

1. Set the multimeter to the appropriate resistance range.
2. Connect the resistor terminals to the multimeter probes.
3. Record the measured resistance value.

Part C: Comparison of Tolerance

1. Calculate the range of resistance using the formula:
$$\text{Range} = R \pm (\text{Tolerance} \times R)$$
2. Verify if the measured value falls within this range.

Part D: Series and Parallel Resistance

1. Connect two resistors (R_1 and R_2) in series.
   - Measure the equivalent resistance using the multimeter.
   - Verify it using the formula $R_s = R_1 + R_2$.
2. Connect the same resistors in parallel.
   - Measure the equivalent resistance using the multimeter.
   - Verify it using the formula $\frac{1}{R_p} = \frac{1}{R_1} + \frac{1}{R_2}$.

Observations

Resistance Identification and Verification

Resistor	Color Bands (AB-C)	Nominal Value (Ω)	Tolerance (%)	Measured Value (
R1				
R2				

Series and Parallel Resistance

Combination	Theoretical Value (Ω)	Measured Value (Ω)	Difference (Δ)
Series			
Parallel			

Calculations

1. Decode resistance values using the color code chart.
2. Verification of measured values within the tolerance range.
3. Calculation of series and parallel resistances.

Result

1. The resistance values obtained from the color code closely match the values measured using the multimeter.
2. The measured values fall within the specified tolerance range.
3. Theoretical and experimental values of series and parallel resistances are consistent.

Conclusion

- The color code method provides an effective way to determine resistor values.
- Multimeter measurements confirm the nominal values within the tolerance range.
- Series resistance adds, while parallel resistance decreases, as per the theoretical formulas.

Precautions

- Ensure clean and tight connections while using the multimeter.
- Avoid touching the resistor terminals during measurement to prevent errors due to body resistance.
- Use the correct range setting on the multimeter to avoid damage to the device.