BIRZEIT UNIVERSITY

Faculty of Science كليــة العلــوم

Department of Physics دائــرة الفيــزيــاء

Phys111 Report

Experiment #4: DC Circuit

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(1) Abstract:

- **Aim of the experiment:**

To calculate the value of an unknown resistance and to find if it ohmic or non-omhic, and to find the value of R ,R_S and R_p .

- **The main results are:**

$$\boldsymbol{R} = 100 \ \pm 11\,\Omega$$
$$\boldsymbol{R_s} = \ 300 \ \pm \ 50\,\Omega$$
$$\boldsymbol{R_p} = \ 62 \ \pm 14\,\Omega$$

(2) Data:

Part A: One resistor circuit

	1.	2.	3.	4.	5.	6.
$\boldsymbol{I}\ (\boldsymbol{mA})$	5mA	10mA	15mA	20mA	25mA	**30mA**
$\boldsymbol{V}\ (\boldsymbol{volts})$	**0.5v**	**1.0v**	**1.5v**	**2.0v**	**2.5v**	**3.0v**

$\boldsymbol{\Delta I}$ =1mA	$\boldsymbol{\Delta V}$ =0.1v

Part B: Two resistors in series

$\boldsymbol{I_s}$ = 16mA	$\boldsymbol{V_s}$ = 5v
$\boldsymbol{\Delta I_s}$ = 1mA	$\boldsymbol{\Delta V_s}$ = 0.5mA

Part C: Two resistors in parallel

$\boldsymbol{I_p}$ =80mA	$\boldsymbol{V_p}$ =5v
$\boldsymbol{\Delta I_p}$ =10mA	$\boldsymbol{\Delta V_p}$ =0.5v

> Note: the result of V, I in ΔR is the average of my readings in the experiment.
>
> $V_{average}$ = 1.75 Ω
>
> $I_{average}$ = 17.5 Ω

(3) Calculations:

Part A: One resistor circuit

From the Graph :(in the last page)

From Graph	$R = 100\ \Omega$	***From Color code***	$R = 100\ \Omega$
	$\Delta R = 11.42857143\ \Omega$		$\Delta R = 5\ \Omega$

To find ΔR **I need to Derivation** (R = $\frac{V}{I}$) ➔ ΔR = R x($\frac{\Delta V}{V} + \frac{\Delta I}{I}$) = 100 x($\frac{0.1}{1.75} + \frac{1}{17.5}$) =11.42857143

Resistance form color code

Brown	Black	Brown	Gold
$R_1 = 100 \pm 5\ \Omega$			

Red	Black	Brown	Gold
$R_2 = 200 \pm 10\ \Omega$			

Part B: Two resistors in series

From Experiment	$R_s = \frac{Vs}{Is} = \frac{5}{16 \times 10^{\wedge}3}$ = 312.5 Ω	***From Color code***	R_s = $R_1 + R_2$ = 100 + 200 = 300Ω
	ΔR_s = 50.78125 Ω		ΔR_s = $\Delta R_1 + \Delta R_2$ = 5 + 10 = 15Ω

***To find ΔR_s I need to Derivation** ($R_s = \frac{Vs}{Is}$) ➔ ΔR_s = R_s ($\frac{\Delta Vs}{Vs} + \frac{\Delta Is}{Is}$) = 312.5($\frac{0.5}{5} + \frac{1}{16}$) =

Part B: Two resistors in series

From Experiment	$R_p = \frac{Vp}{Ip} = \frac{5}{80 \times 10^{\wedge}3}$ = 62.5 Ω	***From Color code***	$R_p = \frac{R1 \times R2}{R1 + R2} = \frac{100 \times 200}{100 + 200}$ = 66.6667Ω ≈ 70Ω
	ΔR_p = 14.0625 Ω		ΔR_p = 10.000005 Ω

***To find ΔR_p I need to Derivation** ($R_p = \frac{Vp}{Ip}$) ➔ ΔR_p = R_p ($\frac{\Delta Vp}{Vp} + \frac{\Delta Ip}{Ip}$) = 62.5($\frac{0.5}{5} + \frac{10}{80}$) =

(4) Results:

$R =$	$100 \pm 11\ \Omega$
$R_s =$	$310 \pm 50\ \Omega$
$R_p =$	$62 \pm 14\Omega$

*** I want to suppose: A = R_1 x R_2, B = $R_1 + R_2$ ➔➔ A= 100 x 200 = 20000 /// B = 100+ 200 = 300

diff. A, B ➔ $\Delta A = R_1 \times \Delta R2 + R_2 \times \Delta R1$;; $\Delta B = \Delta R1 + \Delta R2$ ➔➔ ΔA = 100 x 10 + 200 x 5 = 20000 /// ΔB = 10 + 5 = 15

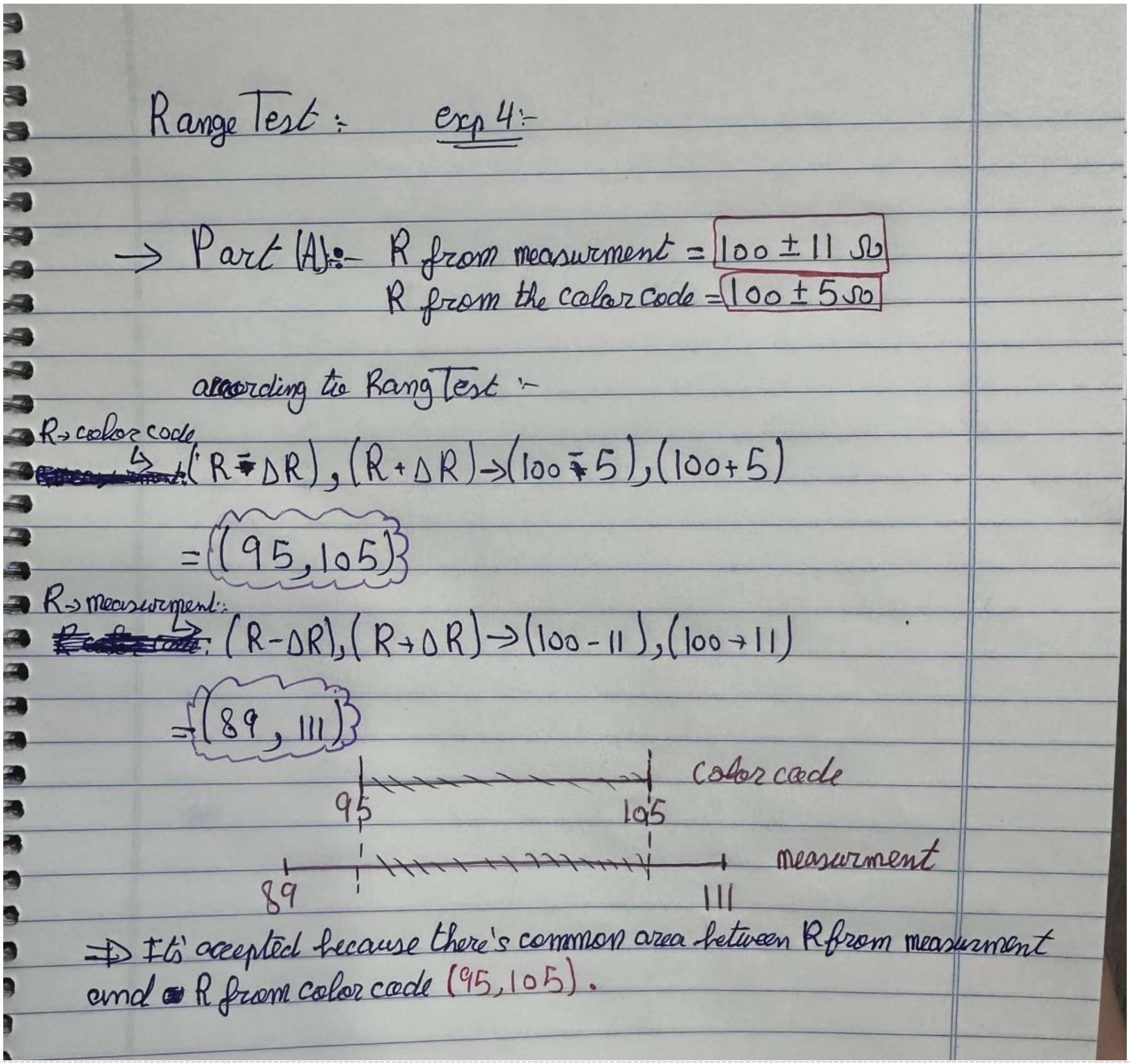
***To find ΔR_p I need to Derivation** ($R_p = \frac{R1 \times R2}{R1 + R2}$) = ΔR_p = ($\frac{A}{B}$)

ΔR_p = R_p x ($\frac{\Delta A}{A} + \frac{\Delta B}{B}$) = 66.6667($\frac{2000}{20000} + \frac{15}{300}$) =

(5) Conclusions:

After I did the readings and calculations in the experiment, if I want to know if the results are acceptable or not, I need to make the **range test** for each resistance:

Part (A): R



Part(B): R_s

Part(B):- R_s from measurment = $310 \pm 50\Omega$

R_s from color code = $300 \pm 15\Omega$

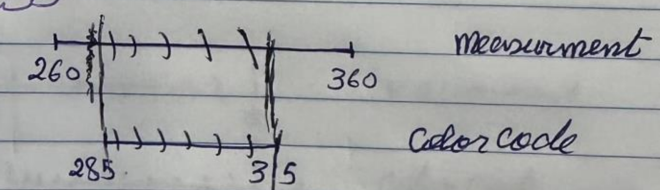
according to Range Test :→

R color code → $(R_s \mp \Delta R_s), (R_s + \Delta R_s) \rightarrow (300-15), (300+15)$

$= \{285, 315\}$

R measurement → $(R_s - \Delta R_s), (R_s + \Delta R_s) \rightarrow (310-50), (310+50)$

$= \{260, 360\}$



⇒ it's accepted because there's common area between R_s from measurment and R_s from color code (285, 315).

Part (C) : R_p

Part (C) :- R_p from measurement = $62 \pm 14\,\Omega$

R_p from color code = $70 \pm 10\,\Omega$

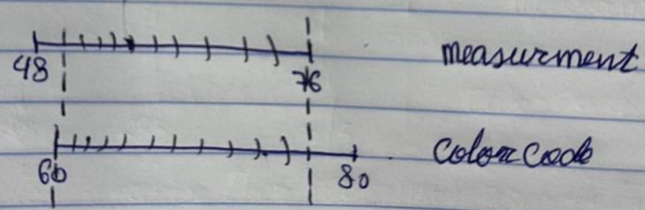
according to Range Test :-

R → measurement → $(R_p \mp \Delta R_p), (R_p + \Delta R) \rightarrow (62 \mp 14), (62+14)$

$= (48, 76)$

R → color code → $(R_p - \Delta R_p), (R_p + \Delta R) \rightarrow (70 - 10), (70 + 10)$

$= (60, 80)$



⇒ it's accepted because there's common area between R_p from measurement and R_p from color code (60, 76)

0.25" Quad Ruled Graph Paper

Malek Zeghari , 1230358 Exp4

$$R(\text{Graph}) = \text{slope} = \frac{\Delta V}{\Delta I} = \frac{V(6) - V(1)}{I(6) - I(1)}$$

$$= \frac{3.5 - 0.5}{(30 - 5)\times 10^{-3}} \rightarrow \boxed{100\,\Omega}$$

* نقوم بالتحويل من mA ← A عن طريق الضرب $(\times 10^{-3})$

V VS I