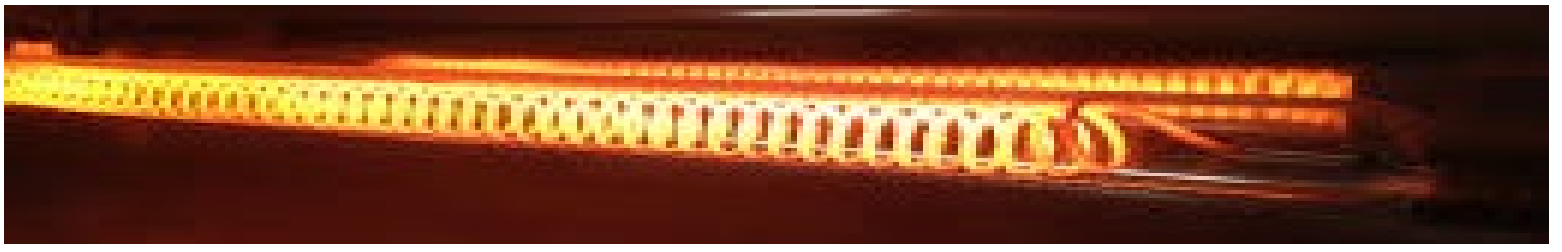
WelTec
Te Whare Wānanga o te Awakairangi

EE3103 3
Resistance, resistivity and resistors workbook

Student name



EE3103 Resistance, resistivity and resistors assignment 1

1) How does an increase in length affect a conductors resistance

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2) What are 4 other factors that affect resistance

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3) Write the unit symbol for the measurement of resistance

……

4) Write the formula for resistivity? ……..

5) Write the unit of measurement for resistivity? ……..

6) What does tempco stand for? ……

7) What does R_0 stand for? ……

8) What is the resistivity of copper? ……

9) Explain the difference between a linear and non-linear resistor

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10) What is the difference between a fixed and variable resistor?

……

……

11) Give an example of each of the 2 terms for Q9 and 2 terms for Q10

……, ……,

……., …….....,

12) What metal is used in a wire wound resistive element?

……..……..

13) Explain why a VDR is wired in parallel with the load?

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14) Why does an LDR use a bi metal switch to operate a luminare?

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15) What application is common for a wire wound resistor

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16) What application is common for a PTC thermistor

……

17) Name each of the 7 resistors on the front of this workbook

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EE3103 Resistance, resistivity and resistors assignment 2

1) Explain in your own words “tolerance”

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……

2) Explain the difference between “power rating” and “power dissipation”

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3) Why are colour codes used on resistors

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……

4) What does Brown, red, orange mean as coloured bands on a resistor

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5) What is the advantage of a 5 band resistor colour code system

……

……

6) What is the minimum voltage applied for an insulation resistance test

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7) How does length affect insulation resistance

……

……

8) Give 3 examples of what can cause a cable to fail an insulation resistance test?

A) ……

B) ……

C) ……

9) With the aid of a graph explain how a VDR protects electrical equipment

……..

……..

……..

10) What is the effect on a cable of exceeding the **voltage** rating

……..…

……..

11) What is the effect on a cable of exceeding the **current** rating

……..…

……..

Work Sheet 22A. Resistance / Resistivity / Tempco.

Show workings.

Material	Resistivity ($\mu\Omega$m at 20^0C)	Temperature Co-efficient (at 0^0C).
Brass	0.066	+0.001
Copper	0.017	+0.00427
Silver	0.016	+0.004
Nichrome	1.122	+0.00017
Aluminium	0.028	+0.00423

1. A cable is made of copper and measures 45m long, the conductor CSA is 10mm^2. Calculate the resistance of the cable.

2. Find the difference in Ohms between a bar 15m long and measuring 3mm x 10mm if it was made from Copper or Brass.

3. Find the Voltage drop that occurs on a 120mm^2 Aluminium cable, 2 km long and carrying 50 A.

4. Calc. the length of 0.75mm^2 Nichrome wire required to make an element of 12 Ohms resistance.

5. For any conductor, an increase in LENGTH, _____ resistance and a decrease in AREA. _____ resistance.

   For a conductor with a positive Tempco, resistance _____ as Temperature increases.

   For a conductor with a negative Tempco, resistance _____ as Temperature increases.

6. The working temperature of a heater element using nichrome wire is 600^0C. Find the resistance at this temperature if the resistance at 0^0C is 5 Ohms.

7. A copper cable has a resistance of 0.2 Ohms at 0^0C. When a short circuit occurs, 3 kV are dropped across the cable as 8 kA flows. Find the temperature the cable reaches during the short circuit - is this good for the insulation?? - Hint: Find the R during the short circuit using Ohms Law then apply the Resistivity formulae.

8. A special motor with silver conductors for windings, has a resistance of 2.7 Ohms at room temperature of 18^0C and when run fully loaded for 30 minutes has a resistance of 3.37 Ohms. Find the average temperature of the conductors at full load.

Color	Color Name	1st digit 1st stripe	2nd digit 2nd stripe	Multiplier 3rd stripe	Tolerance 4th stripe
	Black	0	0	x1	-
	Brown	1	1	x10	1%
	Red	2	2	x100	2%
	Orange	3	3	x1,000	3%
	Yellow	4	4	x10,000	4%
	Green	5	5	x100,000	-
	Blue	6	6	x1,000,000	-
	Violet	7	7	-	-
	Grey	8	8	-	-
	White	9	9	-	-
	Gold	-	-	x0,1	5%
	Silver	-	-	x0,01	10%

EE3103 colour code assignment

Give the colour codes for the following values of resistors (ignore tolerance):

680 Ohm: _____

470k Ohm: _____

4M7 Ohm: _____

470M Ohm: _____

0.22 Ohm: _____

8.2 Ohm: _____

180 Ohm: _____

150k Ohm: _____

8k2 Ohm: _____

3.3 Ohm: _____

State the nominal resistance values of the following colour coded resistors. Answers to be in the appropriate S.I. engineering units. e.g. 15kΩ and not 15,000Ω or $1.5x10^4\,\Omega$

Orange orange brown: _____

Brown red yellow: _____

Brown green brown: _____

Orange white blue: _____

Brown black green: _____

Brown grey orange: _____

Green blue gold: _____

Blue grey silver: _____

Red violet green: _____

Yellow violet orange: _____

Give the colour codes for the following values of resistors (ignor tolerance):

680 Ohm: __**Blue Grey Brown.**

470k Ohm: __**Yellow Violet Yellow.**

4M7 Ohm: __**Yellow Violet Green.**

470M Ohm: __

0.22 Ohm: __**Red Red Silver.**

8.2 Ohm: __

180 Ohm: __**Brown Grey Brown.**

150k Ohm: __

8k2 Ohm: __**Grey Red Red.**

3.3 Ohm: __

State the nominal resistance values of the following colour coded resistors. Answers to be in the appropriate S.I. engineering units. e.g. 15kΩ and not 15,000Ω or $1.5x10^4$ Ω

Orange orange brown: ___**330Ω.**

Brown red yellow:_____**120kΩ.**

Brown green brown: _____**150Ω.**

Orange white blue: _____

Brown black green: _____**1MΩ.**

Brown grey orange: _____

Green blue gold: _____**5.6Ω.**

Blue grey silver: _____

Red violet green: _____2M7Ω or 2.7MΩ.

Yellow violet orange: _____

Insulation Resistance (IR).
Work Sheet 18A.
Basic theory and basic calculations.

1. Insulation Resistance (abbreviated to IR in the rest of this work sheet) can be considered as a number of resistors connected in_____ ,consequently, as the length of a cable is increased the IR will _____, and conversely as the length of a cable decreases the IR will _____ .

2. List 5 factors that will affect the IR of a cable:

   _____ _____

   _____ _____

   _____

3. IR is measured with an _____ (the term MEGGER is a trade name and should not be used in exam answers). This type of device tests IR with an average voltage of _____Volts d.c., which is designed to stress the insulation above that normally applied by the mains voltage to see if the insulation will breakdown with the additional stress. The normal unit for values of IR is the _____.

4. A cable which is 50m long has an IR test result of 10MΩ . What is the IR of 200m of the same cable ?.

5. A 1m long length of cable has an IR test result of 150MΩ. What would be the IR of
   a) 0.5m &
   b) 100m
   of the same cable ?.

6. A 100m drum of cable has an IR of 400MΩ. What is the IR of 75m ?.

Insulation Resistance (IR).
Work Sheet 18B.
Harder theory and calculations.

1. When testing an installation or an appliance, the IR tester is connected between phase / neutral (clamped together) and _____. An important testing consideration is that all switches must be in the _____ position and all circuitry must be tested as being _____.

2. The minimum IR test result for an installation or an appliance is _____.
   When this minimum IR test result is recorded, what is the current that will flow in the earthing conductor of an appliance or the protective earthng conductors for an installation, when 230V ac is connected? _____.

3. A normal test result for a new appliance/installation could be expected to be _____.
   A test result less than the minimum would indicate:_____
   _____

4. Why should the main earthing conductor for an installation be connected to the protective earthing conductor being tested when an IR test is being performed ? _____
   _____
   _____.

5. A cable has an IR test of 77MΩ and is 85m long. What is the IR of 22m of this cable ?.

6. A cable is 45m long. You test a 1m off-cut and and get an IR test result of 12 MΩ. At that point in time your IR tester goes faulty. What could you reasonably expect the IR of the 45m length to be ?

7. An old cable has an IR of 0.35MΩ and is measured at 45m long. What length of this cable would give a test result of 2MΩ.

8. A cable on a drum is of unknown length. You cut 1m off it and the IR test result for this off cut is 180 MΩ. You then test the remaining cable on the drum and record 2 MΩ. What is the length of cable on the drum ?.