ACTIVITY

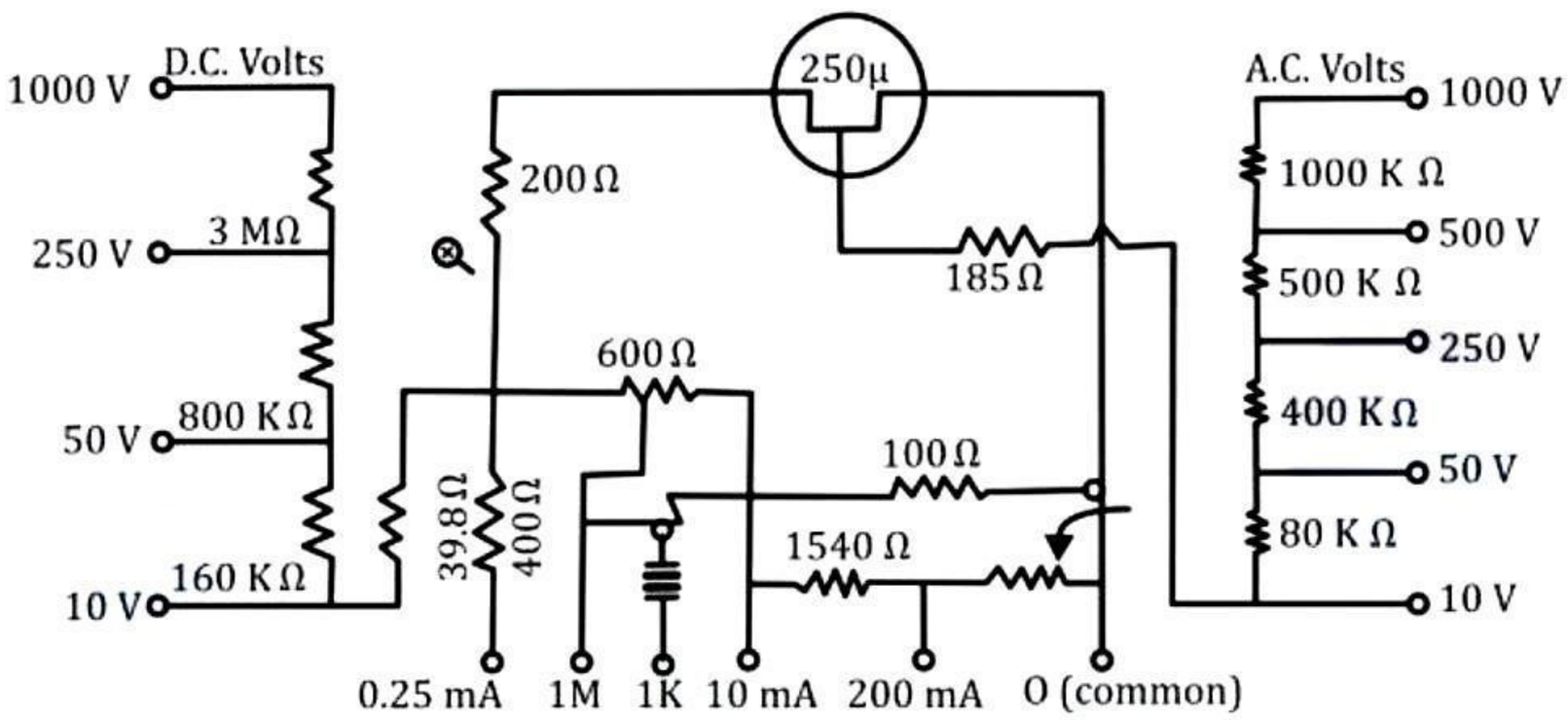
AIM

To measure the resistance voltage (AC/DC), and current (AC), and to check the continuity of the given circuit using a multimeter.

MATERIAL REQUIRED

Carbon resistors, resistance coil, a battery eliminator, variable step-down transformer standard 100 Ω resistors, multimeter, connecting wires, plug key, a sheet of sandpaper.

DIAGRAM



Circuit diagram of a multimeter

THEORY

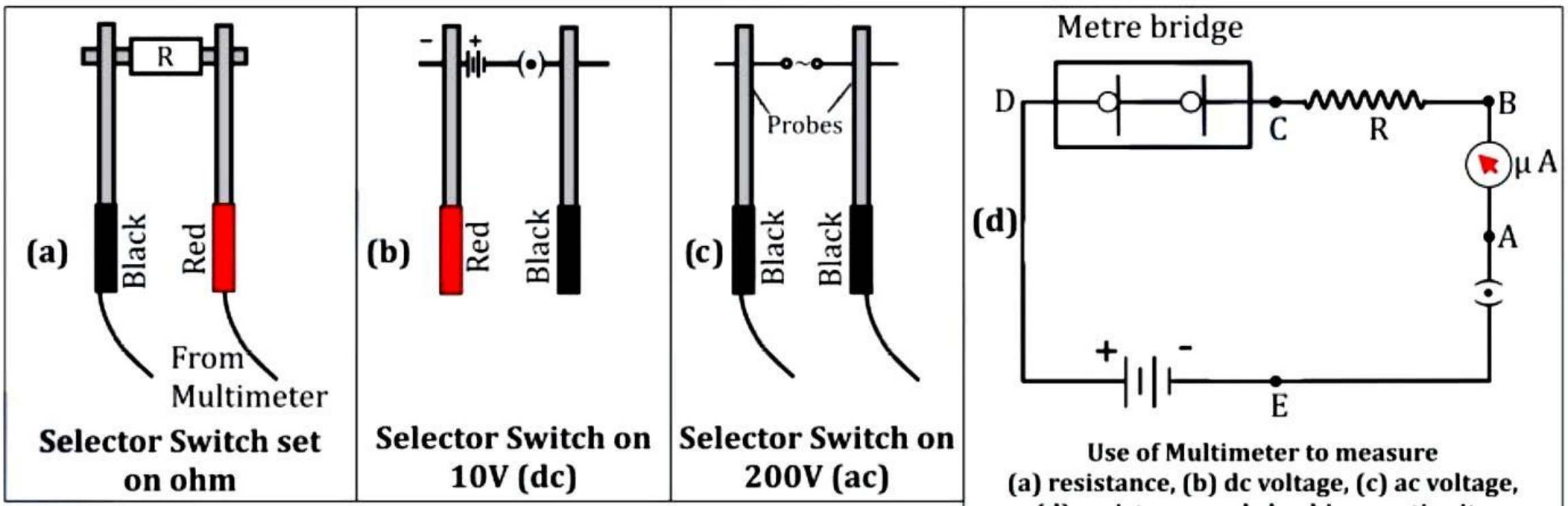
Carbon resistors are electronic circuit components that are made of carbon black, resin, clay, and some conducting wire. These are compact, cost-effective, and available in a wide range. The carbon resistors have specific power ratings. The body of carbon resistors has a set of four coaxial rings which help to find out the value of resistance offered by resistors. Of the four bands of different colours, the first two bands indicate the first two digits of the significant value of resistance, while the third band gives the value of the

decimal multiplier of the number. The fourth band gives the value of tolerance of the resistor, which is measured by the percentage variation of resistance value indicated on the resistor.

Colour	1st band number	2nd band number	3rd band multiplier	4th band tolerance
Black	0	0	$10^0 = 1$	-
Brown	**1**	**1**	**10^1**	**-**
Red	2	2	10^2	-
Orange	**3**	**3**	**10^3**	**-**
Yellow	4	4	10^4	-
Green	**5**	**5**	**10^5**	**-**
Blue	6	6	10^6	-
Violet	**7**	**7**	**10^7**	**-**
Grey	8	8	10^8	-
White	**9**	**9**	**10^9**	**-**
Gold	-	-	10^{-1}	5
Silver	**-**	**-**	**10^{-2}**	**10**
No colour	-	-	-	15

Multimeter: is an electrical measuring device that we use to measure AC/DC current, AC/DC voltage and resistance. Thus, it can indicate readings in ampere (A), volt (V), and ohm (Ω). Thus, it is also called an AVO meter. The multimeter panel consists of a screen that covers the calibrated scales showing readings of the above physical quantities. A pointer is also provided which indicates the appropriate mark to allow the user to measure the physical quantity. An adjustable knob is also provided on the panel to set the pointer at the zero mark of the scale.

The multimeter is set with black lead inserted in the socket marked as 'C' (common) and red lead is inserted in ' t '. The selecting knob is turned to the required quantity and its range manually. When the two probes are touched, the needle shows maximum deflection from zero. This indicates a situation of zero resistance and continuity of the circuit.



PROCEDURE

1. **For measuring resistance**

   (i) Label the given carbon resistors as R_1, R_2 and R_3. Find the value of individual resistance of each by reading their colour code.

(ii) Plug the multimeter probes in relevant terminals, i.e., black probe in terminal indicated by ' C ' and red in ' t′ ' by selecting the appropriate range. Adjust the zero position of the pointer by shorting the probes and rotating the adjusting knob.

(iii) Place the resistance R_1 between the probe tips and read the value of resistance. The pointer shows deflection, and its reading is recorded in the observation table.

(iv) Similarly, values of resistance R_2 and R_3 are also obtained.

(v) The values of resistances according to the colour code given on the resistor and the obtained values are finally compared.

2. **For measuring D.C. voltage**

(i) The probes of 6 V battery eliminator or battery (whichever is selected) are connected with the black probe in ' C ' and the red probe in 't ' of a multimeter.

(ii) The other ends of probes are put as red on the '+' terminal of the battery and black on the (−) terminal. Reading is taken in this situation.

(iii) Now the red probe is inserted in 2 V, 4 V, 8 V, etc. and readings are taken.

3. **For measuring A.C. voltage**

(i) A multimeter is set for AC voltage mode.

(ii) The probes are connected to the two terminals of a.c. source potential drops and readings are noted down.

(iii) The same process is repeated by finding rms output voltage for other trappings of the transformer.

4. **Checking the continuity of a given circuit**

(i) The multimeter is set for resistance measurement in the least range. The zero-setting knob is adjusted to get the maximum deflection on the joining of leads.

(ii) Take a fuse and press two leads of the multimeter at the ends of the fuse. A full-scale deflection indicates continuity.

(iii) Check the continuity between all the terminals in succession using the same procedure.

OBSERVATION

Resistor used	Colour of rings on carbon resistor				Resistance and tolerance of carbon resistor (Ω)	The measured value of resistance by multimeter (Ω)	% Difference
	1	2	3	4			
R_1							
R_2							
R_3							
R_4							

RESULT

1. The measured values of resistance using multimeter match with the decoded value of resistance from the colour code.
2. The marked a.c. and d.c. voltage match with the measured value.
3. The continuity of the circuit is checked using a multimeter.

PRECAUTION

1. It is essential to carefully review the guidelines for operating the multimeter, as this valuable tool is susceptible to damage if used without proper attention or understanding.
2. Choose the correct measurement parameter—current, voltage, or resistance—and adjust it to the

suitable range for accurate readings.

3. When the range of the measured parameter is uncertain, begin with the maximum setting. When measuring voltage, ensure not to exceed 600 V.

SOURCES OF ERROR

1. Incorrect scale employed for voltage/current readings.
2. Lack of zero adjustment when measuring resistance with an analog multimeter.

SELF-EVALUATION

Is it possible to measure DC voltage/current using the AC voltage/current function switch?

If the two test leads of the multimeter are dissimilar and there is notable resistance across the junctions of the multimeter (test leads and the test resistance), what impact will this have on your measurement?

VIVA- VOCE

Q 1. Why is a multimeter called an AVO meter?

Ans. AVO means the multimeter can measure ampere, volts, and ohms.

Q 2. What does the tolerance of a carbon resistor indicate?

Ans. Tolerance indicates the maximum allowed fluctuation (in percentage) in the resistance of the resistor.

Q 3. What is the function of the adjustable knob on the multimeter panel?

Ans. The adjustable knob is used to adjust the position of the pointer exactly at zero position in no input situation.

Q 4. Why are carbon resistors extensively used? electronic circuits?

Ans. Carbon resistors are cheap, compact, and easily available in a variety of ranges of resistance.

Q 5. On what principle does a multimeter work?

Ans. The multimeter works like a galvanometer. By joining suitable shunts parallel to it, one can measure current directly. On connecting high resistance in series of a galvanometers, a voltmeter is formed. A rectifier is inbuilt, to measure a.c. and alternating voltage.

Q 6. A carbon resistor having three bands is available. What will be its tolerance?

Ans. If the fourth band is absent, tolerance is 20%.