

# POTENTIOMETER - II

AIM :- To determine the internal resistance of a given cell using a potentiometer.

## APPARATUS REQUIRED :-

A potentiometer, a battery, two one-way keys, a jockey, a piece of sand paper, a rheostat, a galvanometer, an ammeter, a high resistance wire, a Leclanche cell, a fractional resistance and a connecting wire

CIRCUIT DIAGRAM :- (see alongside)

## THEORY AND FORMULA

The internal resistance of a cell is given by :-

$$r = R \left( \frac{E - \mu}{E} \right) \longrightarrow \textcircled{1}$$

If  $L_1$  is the length of the potentiometer wire to a point where the balance point is obtained in an open circuit, then  $E = kL_1$ ,  
where  $k$  is the potential gradient along the

potentiometer wire.

If the balance point is obtained at  $L_2$  when the cell sends a current through shunted resistor  $R$  where  $K_2$  is also closed, then the potential difference between the terminals of the cell will be:

$$V = KL_2$$

Putting the values of  $E$  and  $V$  in equation (1) gives :-

$$E = R \left[ \frac{L_1 - L_2}{L_2} \right]$$

### PROCEDURE:-

- 1) Make the connection according to the circuit diagram.
- 2) Now insert a plug in the key in the main circuit so that a current flows in the potentiometer wire.
- 3) Connect a shunt to the galvanometer and determine the approximate balance point. Remove the shunt and obtain an exact balance point.
- 4) Measure the balancing point  $L_1$ .
- 5) Now insert a plug in the key  $K_2$ . Measure the balancing length.
- 6) Repeat the experiment with different values of  $R_1$ , taking observations for open and closed circuits of the primary cell alternatively.

RESULT:- The internal resistance of primary cell is =  $12.78\Omega$

### PRECAUTIONS:-

- 1) The E.M.F of the auxiliary battery should be greater than that of the cell.
- 2) The ammeter reading must remain constant for each set of observation.
- 3) The current should only be passed for a short time.
- 4) You must adjust the rheostat so that the null point lies on the last wire of the potentiometer.
- 5) You should not disturb the cell during the course of the experiment.

### SOURCE OF ERROR:-

- 1) The auxiliary battery may not be fully charged.
- 2) The end resistance may not be zero.
- 3) Any error in measuring the length of the wire will affect the result.
- 4) Approximation in detecting the null point deflection will certainly affect the result.

[On L.H.S]

