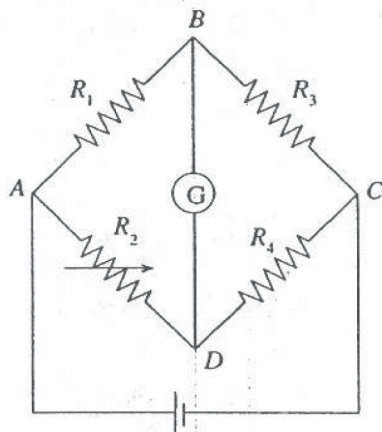


2001 A/L Structured Essay Question No (04)

4. A bridge circuit is shown in the diagram.  $R_1$ ,  $R_3$  and  $R_4$  are resistances and  $R_2$  is a variable resistance.  $G$  is a centre zero galvanometer.



- (a) When  $R_2$  increases from zero to a very high value what would you observe in the variation of the deflection of the galvanometer?

.....

- (b) When the bridge is balanced for a certain value of  $R_2$ , the currents through  $R_1$  and  $R_2$  are  $I_1$  and  $I_2$  respectively.

- (i) What are the currents through  $R_3$  and  $R_4$ ?

.....

- (ii) What is the potential difference between  $B$  and  $D$ ?

.....

- (iii) Write down the relationships between

$V_{AB}$  (potential difference between  $A$  and  $B$ ) and  $V_{AD}$  .....

$V_{BC}$  and  $V_{DC}$  .....

- (iv) Write down expressions for  $V_{AB}$ ,  $V_{BC}$ ,  $V_{AD}$  and  $V_{DC}$ , in terms of  $R_1$ ,  $R_2$ ,  $R_3$ ,  $R_4$ ,  $I_1$  and  $I_2$ .

$V_{AB} = \dots\dots\dots V_{BC} = \dots\dots\dots$

$V_{AD} = \dots\dots\dots V_{DC} = \dots\dots\dots$

- (v) Obtain an expression for  $R_4$  in terms of  $R_1$ ,  $R_2$  and  $R_3$ .

.....

.....

- (vi) If  $R_1 = 100 \Omega$ ,  $R_3 = 50 \Omega$ , and  $R_2 = 82 \Omega$ , find the value of  $R_4$ .

.....

.....

(c) A student wants to use the above bridge to measure a very small resistance  $r$  ( $< 1 \Omega$ ). He is provided with the following.

Three  $10 \Omega$ ,  $100 \Omega$  and  $1000 \Omega$  resistors.

Two  $0 - 100 \Omega$  and  $0 - 1000 \Omega$  resistance boxes.

He replaces  $R_4$  with the unknown resistor  $r$ . Which of the above resistors or resistance boxes should he select for  $R_1$ ,  $R_2$  and  $R_3$  in order to determine  $r$  as accurately as possible?

For  $R_1$  .....

For  $R_2$  .....

For  $R_3$  .....

(d) When the bridge is balanced, if the cell and the galvanometer are exchanged what should be the deflection of the galvanometer?

.....