6

(a)

A student wishes to determine the *I*-*V* characteristics of a semiconductor diode.

(i)

Draw a suitable labelled diagram of the circuit that would enable the student to collect data to determine the *I*-*V* characteristics of the semiconductor diode.

[2]

(ii)

Sketch, on Fig. 6.1, the *I*-*V* characteristics of a semiconductor diode in forward bias.

Fig. 6.1

[1]

(iii)

State how the resistance of the diode can be determined from Fig. 6.1.

……

……. [1]

(b)

Four ideal diodes are arranged in the circuit as shown in Fig. 6.2.

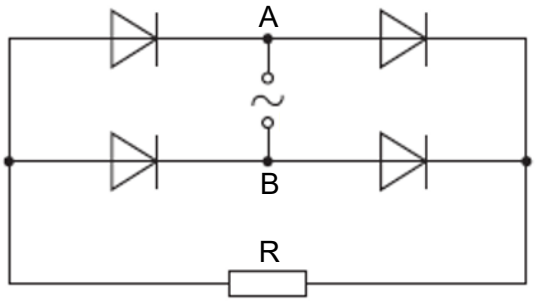


Fig. 6.2

A 7.0 V sinusoidal a.c. voltage supply at 25 Hz is applied between points A and B.

(i)

Circle the diode(s) that conduct when point B is positive with respect to point A. [1]

(ii)

Calculate the maximum voltage V_{max} across the resistor R.

V_{max} = ... V [1]

(iii)

Three of the diodes are removed and resistor R is connected to a diode, a cathode-ray oscilloscope (c.r.o.) and the 7.0 V sinusoidally-alternating voltage supply via a switch as shown in Fig. 6.3.

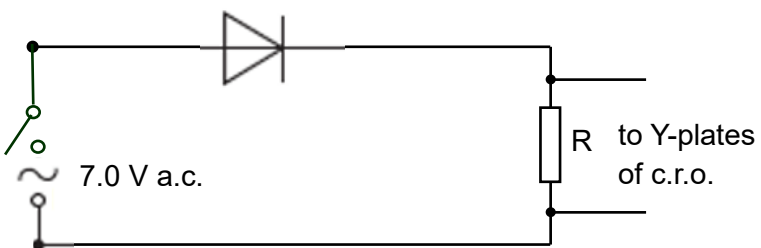
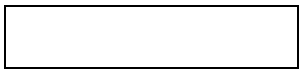


Fig. 6.3

The Y-plate sensitivity of the c.r.o is 5.0 V cm^{-1} and time base is 10 ms cm^{-1}.

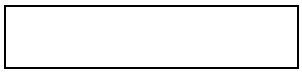
When the switch is opened, a horizontal trace is obtained as shown in Fig. 6.4.

Fig. 6.4



1.

Sketch, on Fig. 6.4, the full trace shown on the c.r.o. screen when the switch is closed. [2]



2.

Calculate the resistance of resistor R given that the mean power dissipated in it is 4.5 W.

resistance = ……Ω [2]

[Total: 10]