KOLEJ YAYASAN PELAJARAN JOHOR
FINAL EXAMINATION

COURSE NAME	**:**	**INDUSTRIAL ELECTRONICS**
COURSE CODE	**:**	**DKE 3043**
SESSION	**:**	**NOVEMBER 2020**
DURATION	**:**	**2 HOURS 30 MINUTES**

INSTRUCTION TO CANDIDATES /
ARAHAN KEPADA CALON

1. This examination paper consists of **TWO (2)** part: / PART A (20 Marks) / PART B (80 Marks) /
   *Kertas soalan ini mengandungi **DUA (2)** bahagian:* *BAHAGIAN A (20 Markah)* *BAHAGIAN B (80 Markah)*

2. Answer **ALL** questions in an answering booklet provided. Sketch a diagram if neccessary to help illustrate your answer. /
   *Jawab **SEMUA** soalan di dalam buku jawapan yang disediakan**.** Lakarkan gambarajah jika perlu bagi membantu menggambarkan jawapan anda.*

3. Candidates are not allowed to bring any material to examination room except with the permission from the invigilator. /
   Calon tidak dibenarkan untuk membawa masuk sebarang peralatan ke dalam bilik peperiksaan kecuali dengan kebenaran pengawas peperiksaan.

4. Please check to make sure that this examination pack consist of: /
   Pastikan kertas soalan peperiksaan ini mengandungi:

   i. The Question Paper /
   Kertas Soalan.

   ii. An Answering Booklet /
   Buku Jawapan.

DO NOT TURN THIS PAGE UNTIL YOU ARE TOLD TO DO SO /
JANGAN BUKA KERTAS SOALAN INI SEHINGGA DIBERITAHU

PART A / *BAHAGIAN A*

This part consists of **FOUR (4)** questions. Answer **ALL** the questions in an answering booklet.

*Bahagian ini mengandungi **EMPAT (4)** soalan. Jawab **SEMUA** soalan dalam buku jawapan.*

QUESTION 1 / *SOALAN 1*

When the line input voltage, V_i for a practical voltage regulator change from 14 V to 12 V, it is found that the output voltage, V_O will change from 9 V to 8 V. Find the percentage of line regulation and the percentage of load regulation for the voltage regulator.

(*5 marks / *markah)

Apabila voltan masukan talian, V_i bagi satu pengatur voltan praktikal berubah dari 14 V ke 12 V, didapati bahawa voltan keluaran, V_O akan berubah dari 9 V ke 8 V. Dapatkan peratus pengaturan talian dan peratus pengaturan beban bagi pengatur voltan tersebut.

QUESTION 2 / *SOALAN 2*

RC Phase Shift Oscillator at **Figure Q2** uses 741 operational amplifier and V_{CC} = ± 10 V. Given $R_1 = R_2 = R_3$ = 10 kΩ and $C_1 = C_2$ = 0.0065 µF. Find the value of:

a. oscillation frequency, f_O for the circuit

(*2 marks / *markah)

b. R_f to ensure the circuit operates as oscillator.

(*3 marks / *markah)

*Pengayun Anjakan Fasa RC pada **Rajah Q2** menggunakan penguat kendalian 741 dan V_{CC} = ± 10 V. Diberikan $R_1 = R_2 = R_3$ = 10 kΩ dan $C_1 = C_2$ = 0.0065 µF. Dapatkan nilai:*

a. frekuensi ayunan, f_O bagi litar tersebut.

b. R_f untuk memastikan litar beroperasi sebagai pengayun.

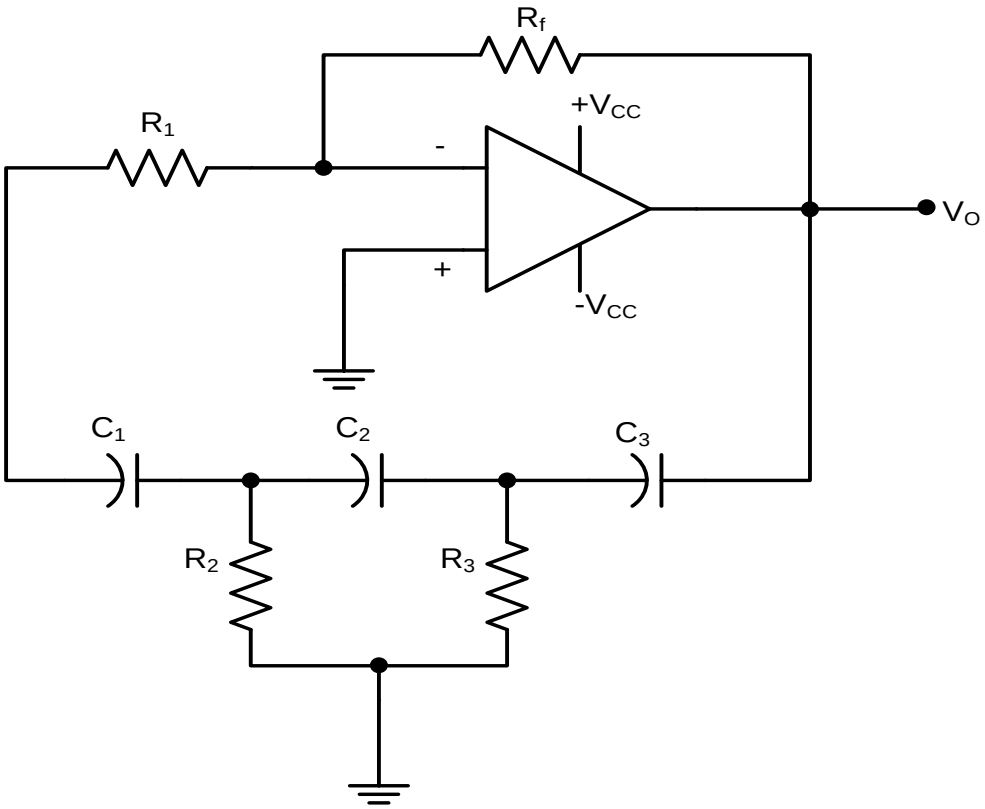

Figure Q2 / ***Rajah Q2***

QUESTION 3 / ***SOALAN 3***

Label completely I-V characteristic curve of silicon controlled rectifier, SCR.

(*5 marks /** ***markah)

Labelkan dengan lengkap lengkung cirian I-V bagi penerus terkawal silikon, SCR.

QUESTION 4 / *SOALAN 4*

Define about the transfer current ratio, CTR. Next, find the transfer current ratio, CTR for the optical coupler when the current in the LED is 20 mA, the collector to emitter transistor voltage is 10 V and the collector current is 20 mA. Assume $I_B = 0$.

(*5 marks / *markah)

Takrifkan perihal nisbah arus pindah, CTR. Seterusnya, dapatkan nisbah arus pindah, CTR bagi pengganding optik apabila arus dalam LED adalah 20 mA, voltan pemungut ke pemancar transistor adalah 10 V dan arus pemungut adalah 20 mA. Anggap $I_B = 0$.

PART B / *BAHAGIAN B*

This part consists of **FOUR (4)** questions. Answer **ALL** the questions in an answering booklet.

*Bahagian ini mengandungi **EMPAT (4)** soalan. Jawab **SEMUA** soalan dalam buku jawapan.*

QUESTION 5 / *SOALAN 5*

Referring to **Figure Q5** shows a regulator. Given $\beta_1 = 100$, $\beta_2 = 200$, $V_{BE1} = V_{BE2} = 0.7$ V, $V_Z = 6.3$ V and $V_i = 25$ V.

a. Name the regulator circuit.

(*1 mark / *markah)

b. Determine the value of regulated output voltage, V_O for the regulator circuit.

(*6 marks / *markah)

c. Determine the values of currents I_{R4}, I_{B1}, I_{E1} and I_{C1}

(*8 marks / *markah)

d. Calculate the maximum power rating for transistor, Q_1.

(*5 marks / *markah)

*Merujuk pada **Rajah Q5** menunjukkan sebuah pengatur. Diberi $\beta_1 = 100$, $\beta_2 = 200$, $V_{BE1} = V_{BE2} = 0.7$ V, $V_Z = 6.3$ V dan $V_i = 25$ V.*

a. Namakan litar pengatur tersebut.

b. Tentukan nilai voltan keluaran teratur, V_O bagi litar pengatur tersebut.

c. Tentukan nilai arus I_{R4}, I_{B1}, I_{E1} dan I_{C1}

d. Kira kadaran kuasa maksimum bagi transistor, Q_1.

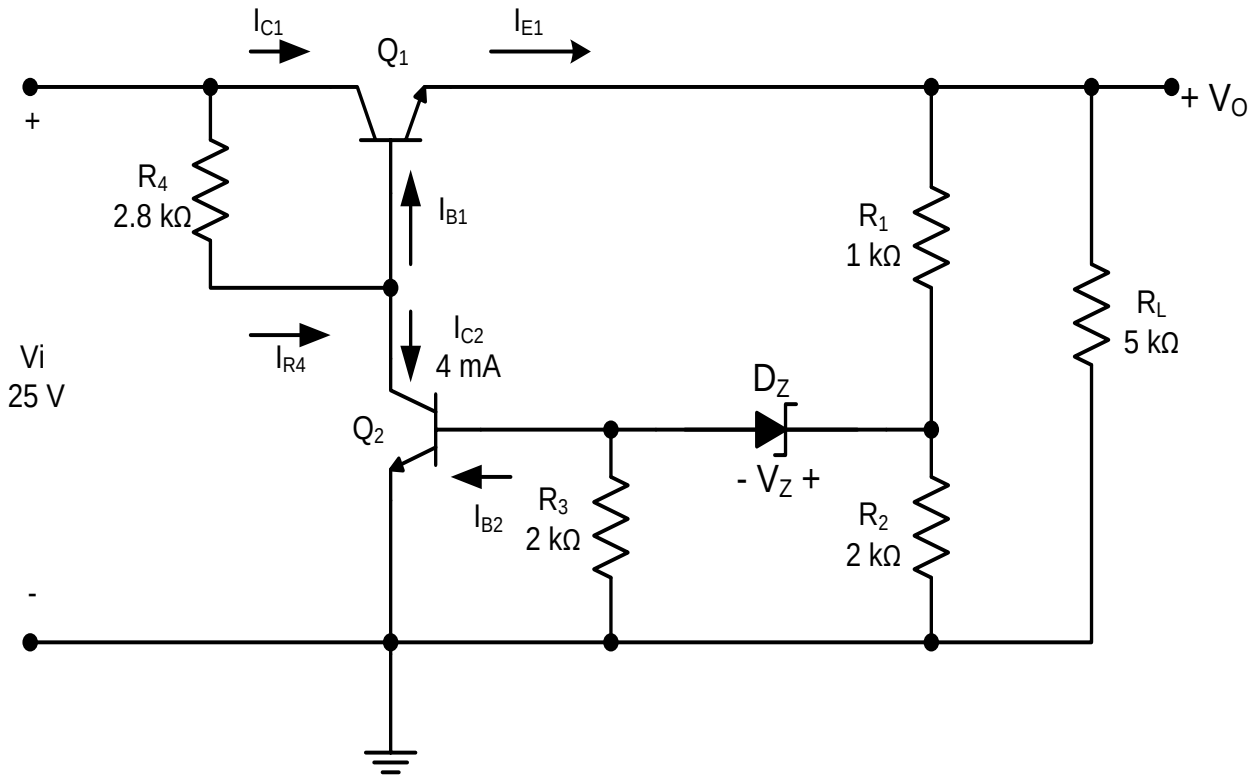

Figure Q5 / ***Rajah Q5***

QUESTION 6 / ***SOALAN 6***

Referring to **Figure Q6.**

a. Prove the equations for oscillation frequency, $f_o = \frac{1}{2\pi\sqrt{C(L_1+L_2)}}$ and amplifier gain, $A = \frac{V_O}{V_f} = -\frac{L_2}{L_1}$ when oscillation occurs.

(*12 marks /** ***markah)

b. If the inductor value $L_1 = L_2 = 0.125$ mH and capacitor C = 0.01 µF, calculate the oscillation frequency, f_O, the amplifier gain, A and the feedback gain, β during oscillation is maintained.

(*8 marks /** ***markah)

*Merujuk pada **Rajah Q6.***

a. *Buktikan persamaan untuk frekuensi ayunan,* $f_o = \frac{1}{2\pi\sqrt{C(L_1 + L_2)}}$ *dan gandaan penguat,* $A = \frac{V_O}{V_f} = -\frac{L_2}{L_1}$ *apabila pengayunan berlaku.*

b. *Jika nilai pearuh L_1 = L_2 = 0.125 mH dan pemuat C = 0.01 µF, kira frekuensi ayunan, f_O, gandaan penguat, A dan gandaan suapbalik, β semasa pengayunan dikekalkan.*

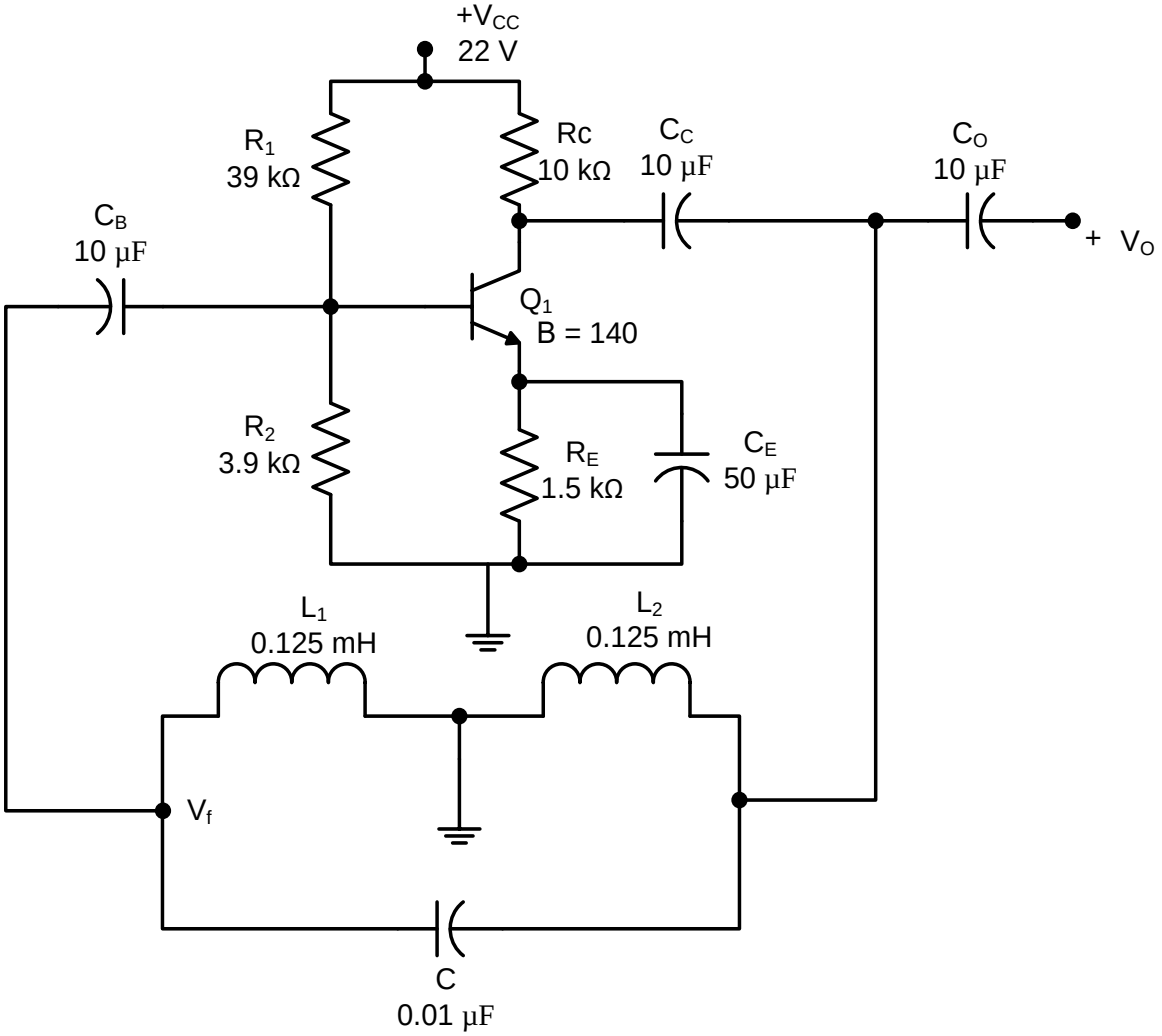

Figure Q6 / *Rajah Q6*

QUESTION 7 / *SOALAN 7*

Referring to **Figure Q7**, given peak input voltage, $V_{i(peak)}$ = 100 V, load resistance, R_L = 10 Ω, resistance, $R_1 = R_2$ = 4.7 kΩ, gate trigger current, I_{GT} = 50 µA, gate trigger voltage, V_{GT} = 1 V and breakover voltage for device P = 20 V.

a. Determine the firing angle.

(*6 marks / *markah)

b. Calculate the maximum power of an alternating current across the load, R_L.

(*4 marks / *markah)

c. Calculate the percentage of the maximum power supplied to the load at the firing angle in (a).

(*10 marks / *markah)

*Merujuk pada **Rajah Q7**, diberi voltan masukan puncak, $V_{i(puncak)}$ = 100 V, rintangan beban, R_L = 10 Ω, rintangan, $R_1 = R_2$ = 4.7 kΩ, arus picuan get, I_{GT} = 50 µA, voltan picuan get, V_{GT} = 1 V dan voltan pecah lampau bagi peranti P = 20 V.*

a. Tentukan sudut picuan.

b. Kira kuasa maksimum arus ulang alik yang terbina merentasi beban, R_L.

c. Kira peratusan kuasa maksimum yang dibekalkan ke beban pada sudut picuan dalam (a).

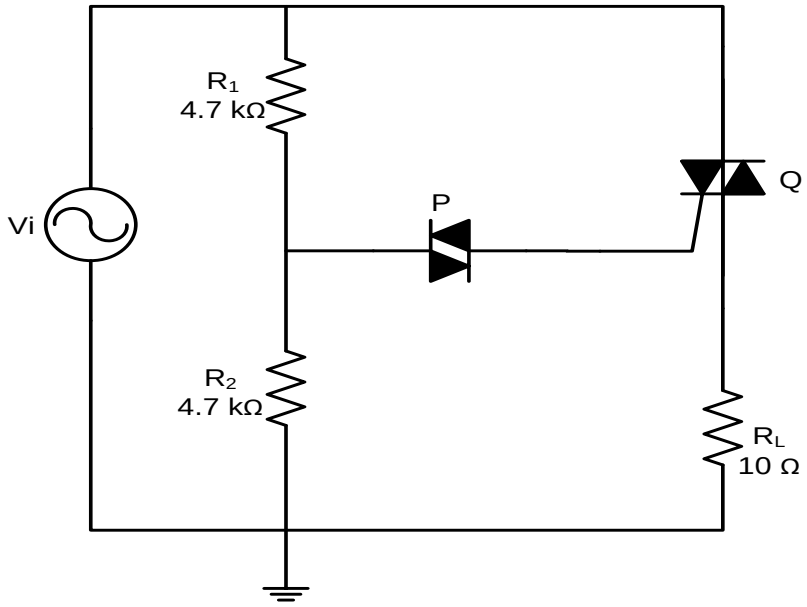

Figure Q7 / ***Rajah Q7***

QUESTION 8 / ***SOALAN 8***

The circuit in **Figure Q8a** is used to calculate the number of students entering the library. The light beam placed across the entrance. The light beam will hit the light dependent resistor, LDR and it will break when there are students through the door.

a. Determine the voltage value at Y.

(*4 marks /** ***markah)

b. The resistance value of the light dependent resistor, R_{LDR} changes with the brightness of the light as shown in **Figure Q8b**.

i. When the brightness of the light is 50 Im/m^2, the light beam is cut off. From the graph, show the resistance value of the light dependent resistor, $R_{LDR.}$

(*3 marks /** ***markah)

ii. When the brightness of the light is 250 Im/m^2, the light beam is uninterrupted. From the graph, show the resistance value of the light dependent resistor, $R_{LDR.}$

(*3 marks /** ***markah)

iii. If V_{OUT} is a low voltage value, determine the voltage value at X.

(2 marks / *markah)*

iv. Calculate the value of resistance, R_3 if the voltage V_{OUT} is high when the brightness is 100 lm/$m^{2.}$

(8 marks / *markah)*

*Litar pada **Rajah Q8a** digunakan untuk mengira bilangan pelajar yang memasuki perpustakaan. Sinar cahaya diletakkan merintangi pintu masuk. Sinar cahaya tersebut akan mengenai perintang peka cahaya, LDR dan ia akan terputus apabila ada pelajar melalui pintu tersebut.*

a. *Tentukan nilai voltan di Y.*

b. *Nilai rintangan perintang peka cahaya, R_{LDR} berubah dengan kecerahan cahaya seperti ditunjukkan dalam **Rajah Q8b**.*

i. *Apabila kecerahan cahaya adalah 50 lm/m^2, sinaran cahaya terputus. Daripada graf, tunjukkan nilai rintangan perintang peka cahaya, R_{LDR}.*

ii. *Apabila kecerahan cahaya adalah 250 lm/m^2, sinaran cahaya tidak terputus. Daripada graf, tunjukkan nilai rintangan perintang peka cahaya, R_{LDR}.*

iii. *Jika V_{OUT} adalah nilai voltan rendah, tentukan nilai voltan di X.*

iv. *Kira nilai rintangan, R_3 jika V_{OUT} adalah voltan tinggi ketika kecerahan adalah 100 lm/m^2.*

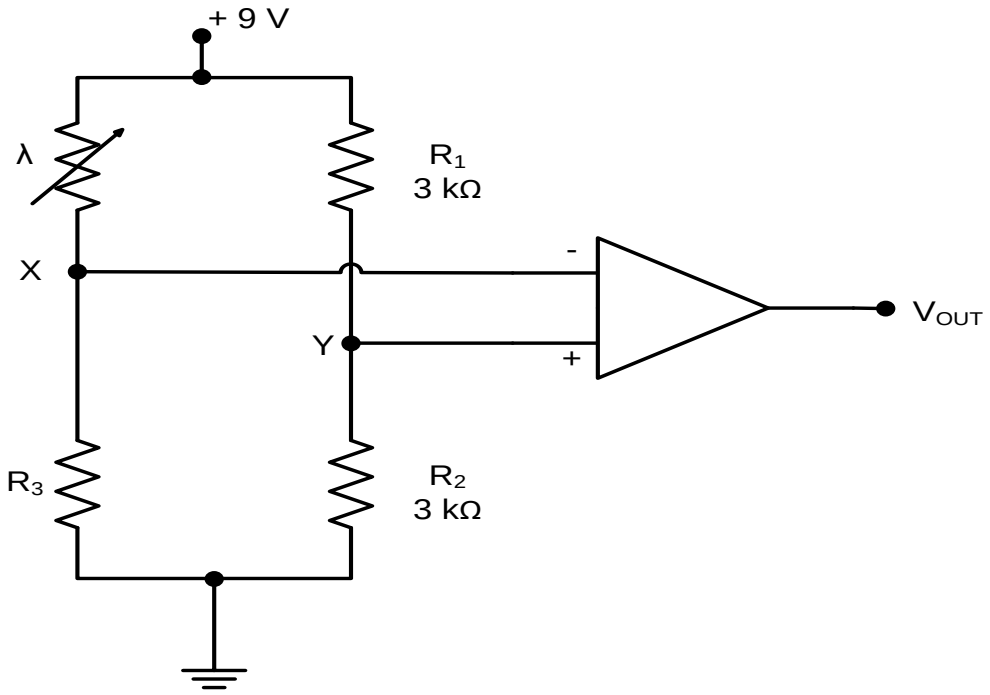

Figure Q8a / ***Rajah Q8a***

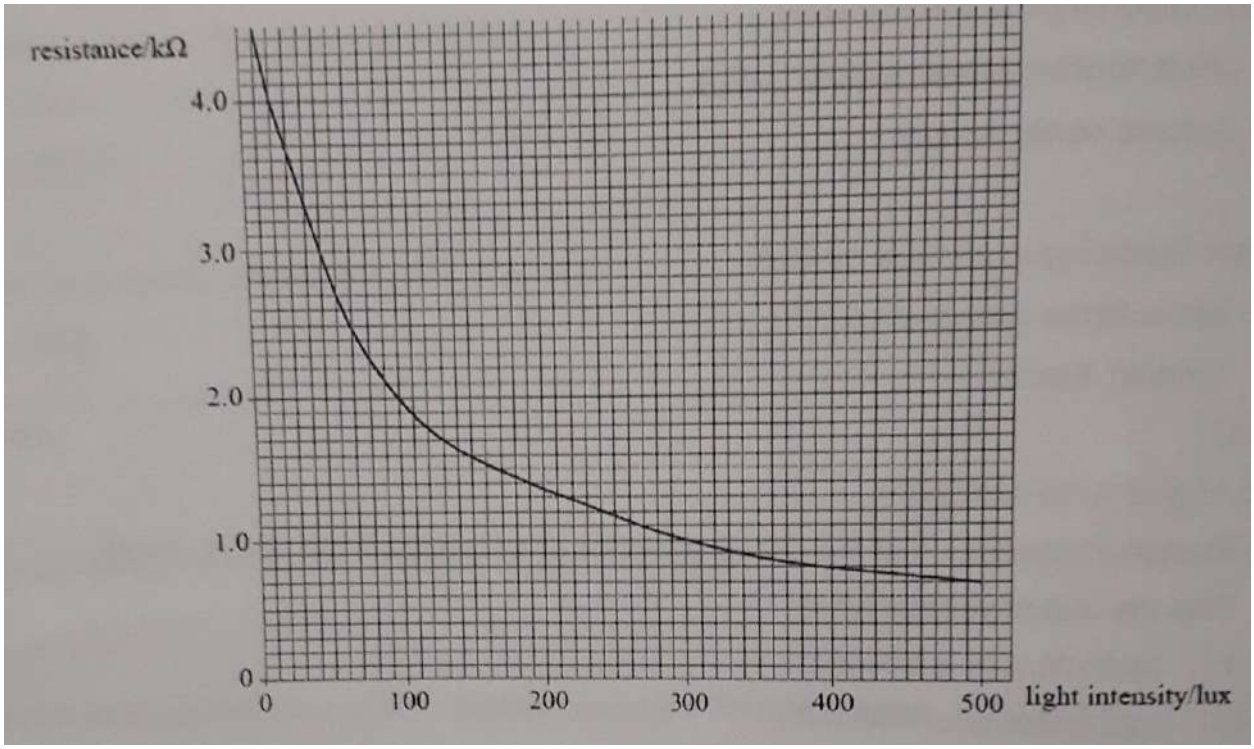

Figure Q8b / ***Rajah Q8b***

[100 MARKS / ***100 MARKAH*****]**

END OF QUESTION PAPER / ***KERTAS SOALAN TAMAT***