

SULIT

UNIVERSITI MALAYSIA PERLIS

Peperiksaan Semester Kedua
Sidang Akademik 2018 / 2019

Mac 2019

DKT 124 Peranti Elektronik
[Electronic Devices]

Masa : 3 jam

Please make sure that this question paper has **THIRTEEN (13)** printed pages including this front page before you start the examination.
*[Sila pastikan kertas soalan ini mengandungi **TIGA BELAS (13)** muka surat yang bercetak termasuk muka hadapan sebelum anda memulakan peperiksaan ini.]*

This question paper has **TWO (2)** part:
*[Kertas soalan ini mengandungi **DUA (2)** bahagian.]*

PART A : This part has **FOUR (4)** questions. Answer **ALL** questions. (80 Marks)
*[Bahagian A : Bahagian ini mengandungi **EMPAT (4)** soalan. Jawab **SEMUA** soalan. (80 Markah)]*

PART B : This part has **TWO (2)** questions. Answer only **ONE (1)** question. (20 Marks)
*[Bahagian B : Bahagian ini mengandungi **DUA (2)** soalan. Jawab **SATU (1)** soalan sahaja. (20 Markah)]*

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PART A

Answer ALL FOUR (4) questions

*[Bahagian A]**[Jawab SEMUA EMPAT (4) soalan]*

Question 1

[Soalan 1]

(a) In principle the materials are divided into three groups; conductor, semiconductor and insulator.

[Pada prinsipnya, bahan-bahan terbahagi kepada tiga kumpulan; pengalir, semikonduktor dan penebat.]

(i) State the **three groups** of material ; conductor, semiconductor and insulator

[Nyatakan tiga kumpulan bahan berikut ; pengalir, semikonduktor dan penebat.]

(3 Marks/ Markah)

(ii) Sketch and label the energy band for each group.

[Lakar dan labelkan jalur tenaga bagi setiap kumpulan]

(6 Marks/ Markah)

(iii) What is different between **intrinsic** and **extrinsic** material?

[Apakah perbezaan antara bahan "intrinsic" dan "extrinsic"?)

(4 Marks/ Markah)

(b) The diode has **THREE (3)** operating condition, no bias, reverse bias and forward bias.

[Diod mempunyai TIGA(3) situasi operasi iaitu tiada pincang, pincang songsang dan pincang hadapan]

(i) Describe and illustrate the depletion region in p-n junction for reverse bias condition.

[Terangkan dan gambarkan kawasan susut dalam simpang p-n untuk keadaan pincang songsang]

(4 Marks/ Markah)

(ii) Describe the difference between the n-type and p-type semiconductor materials.

[Terangkan perbezaan antara jenis-n dan jenis-p bahan semikonduktor]

(3 Marks/ Markah)

Question 2
[Soalan 2]

(a) By assuming both diodes are identical in **Figure 1**, determine:
[Andaikan kedua-dua diod adalah serbasama dan berdasarkan pada **Rajah 1**, tentukan:]

(i) the current through resistor, I_R
[arus merentasi perintang, I_R]

(2 Marks/ Markah)

(ii) the output voltage, V_o
[voltan keluaran, V_o]

(2 Marks/ Markah)

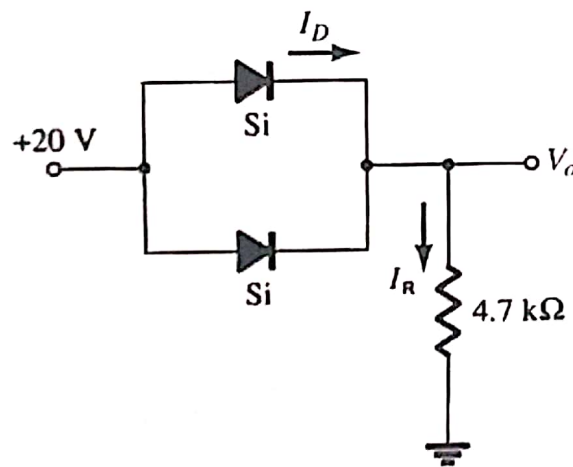


Figure 1
[Rajah 1]

(b) Based on the circuit in **Figure 2**, answer the following questions.
 [Berdasarkan litar pada **Rajah 2**, jawab soalan-soalan berikut.]

(i) State the type of circuit?
 [Nyatakan jenis litar tersebut?]

(1 Mark/ Markah)

(ii) Determine the peak secondary voltage, $V_{p(sec)}$?
 [Tentukan jumlah voltan puncak sekunder, $V_{p(sec)}$?]

(2 Marks/ Markah)

(iii) Determine the peak voltage, V_p across each half of the secondary.
 [Tentukan voltan puncak, V_p yang melalui setiap separuh sekunder.]

(2 Marks/ Markah)

(iv) Sketch and label the voltage waveform across resistance R_L .
 [Lakar dan labelkan bentuk gelombang voltan yang melalui perintang R_L .]

(2 Marks/ Markah)

(v) What is the peak current, I_p through each diode D_1 and D_2 ?
 [Berapakah arus puncak, I_p yang melalui setiap diod D_1 dan D_2 ?]

(2 Marks/ Markah)

(vi) What is the Peak Inverse Voltage (PIV) for each diode D_1 and D_2 ?
 [Berapakah Voltan Balikan Puncak (PIV) bagi setiap diod D_1 dan D_2 ?]

(2 Marks/ Markah)

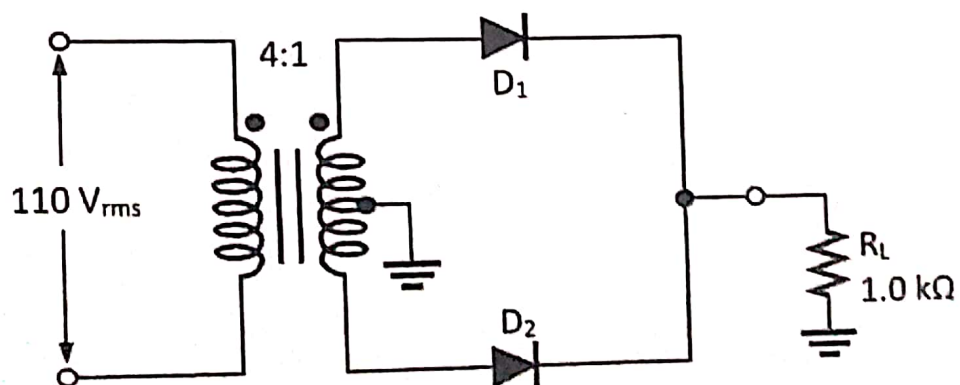


Figure 2
 [Rajah 2]

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(c) Given a full-wave rectifier with a peak output voltage of 30 V. A 50 μF capacitor-input filter

and 600 Ω load resistance are connected to the rectifier. Calculate:

[Suatu penerus gelombang-penuh mempunyai voltan keluaran puncak sebanyak 30 V. Suatu penapis masukan-pemuat 50 μF dan keberintangan beban 600 Ω disambungkan pada penerus tersebut. Kirakan:]

[Assume the frequency = 120 Hz]

- (i) peak-to-peak ripple voltage, $V_{r(pp)}$.
[voltan riak puncak-ke-puncak, $V_{r(pp)}$]

(2 Marks/ Markah)

- (ii) DC output voltage, V_{DC} .
[voltan keluaran AT, V_{DC}]

(2 Marks/ Markah)

- (iii) ripple factor, r .
[faktor riak, r]

(1 Mark/ Markah)

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Question 3

[Soalan 3]

- (a) Sketch and label the symbol of npn and pnp transistor.
[Lakar dan labelkan simbol bagi transistor npn dan pnp.]
- (4 Marks/ Markah)
- (b) State TWO (2) types of biased circuit.
[Nyatakan DUA (2) jenis litar terpincang.]
- (2 Marks/ Markah)
- (c) Briefly explain saturation and cutoff region.
[Terangkan secara ringkas kawasan penepuan dan pemotongan.]
- (3 Marks/ Markah)
- (d) **Figure 3** shows one of the transistor biasing technique. Given that $V_{BE} = 0.7 \text{ V}$, $R_1 = 10 \text{ k}\Omega$, $R_2 = 10 \text{ k}\Omega$ and $R_C = 100 \text{ }\Omega$. Assume that β_{DC} is 100.
[Rajah 3 menunjukkan satu kaedah pemincang bagi sesuatu transistor. Diberikan $V_{BE} = 0.7\text{V}$, $R_1 = 10 \text{ k}\Omega$, $R_2 = 10 \text{ k}\Omega$ and $R_C = 100 \text{ }\Omega$. Anggapkan β_{DC} adalah 100.]
- (i) Name the type of the biased circuit.
[Namakan jenis litar terpincang ini.]
- (1 Mark/ Markah)
- (ii) By using the Thevenin theorem, justify V_{TH} and R_{TH} .
[Dengan menggunakan teori Thevenin, tentukan V_{TH} dan R_{TH} .]
- (4 Marks/ Markah)
- (iii) Solve the value of I_B , I_C and V_{CE} .
[Selesaikan pengiraan bagi I_B , I_C dan V_{CE} .]
- (6 Marks/ Markah)

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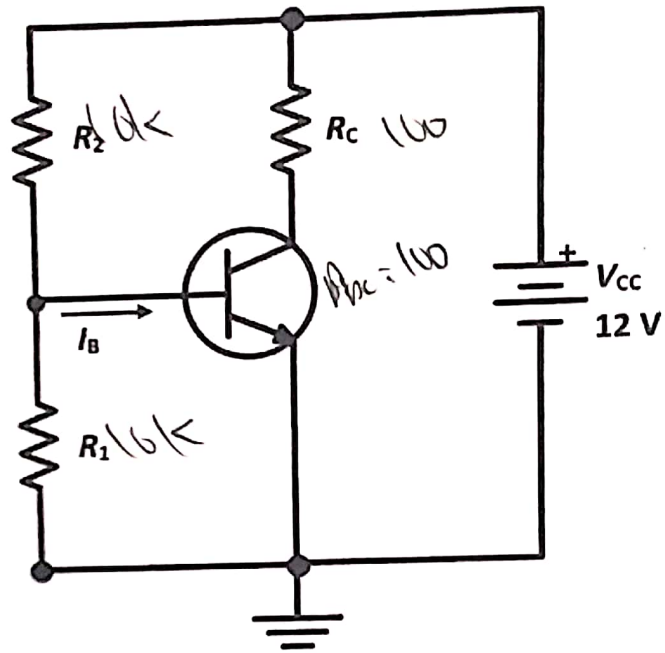
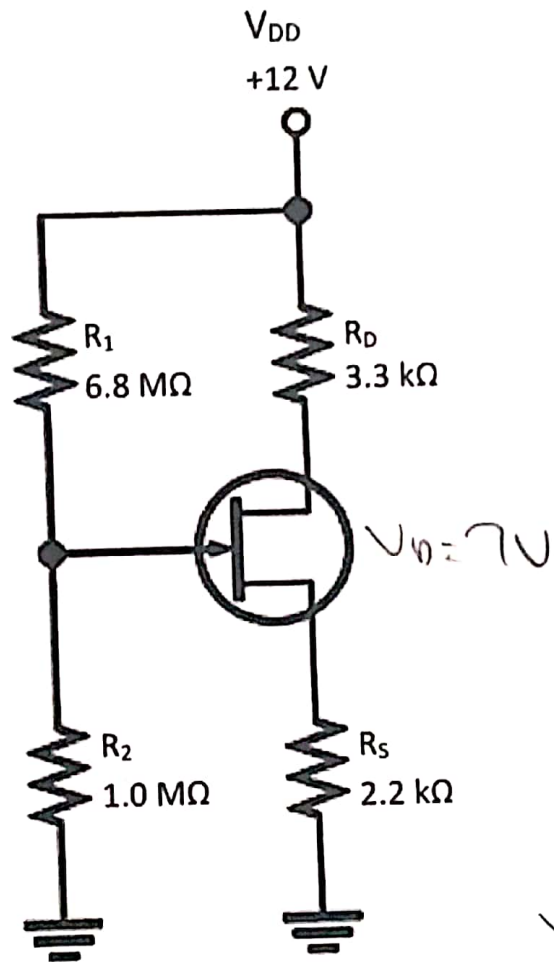


Figure 3
[Rajah 3]

$a = \frac{I_c}{I_B}$

Question 4*[Soalan 4]*

- (a) Sketch and label the drain characteristic curve of a JFET.
[Lakar dan labelkan lengkungan ciri parit bagi JFET.]
- (4 Marks/ Markah)
- (b) Sketch and label the n-type JFET transfer characteristic curve.
[Lakar dan labelkan lengkungan ciri pindahan JFET jenis-n.]
- (4 Marks/ Markah)
- (c) Based on the JFET voltage-divider bias circuit in **Figure 4** with drain voltage, $V_D \cong 7V$ determine:
[Berdasarkan litar JFET pincangan voltan-pembahagi pada Rajah 4 dengan voltan parit, $V_D \cong 7V$, tentukan:]
- (i) drain current, I_D
[arus parit, I_D]
- (3 Marks/ Markah)
- (ii) source voltage, V_S
[voltan sumber, V_S]
- (3 Marks/ Markah)
- (iii) gate voltage, V_G
[voltan get, V_G]
- (3 Marks/ Markah)
- (iv) gate-to-source voltage, V_{GS}
[voltan get-ke-sumber, V_{GS}]
- (3 Marks/ Markah)



$$V_G = \left(\frac{R_2}{R_1 + R_2} \right) V_{DD}$$

Figure 4
[Rajah 4]

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PART B

Answer only ONE (1) question.

[Bahagian B]

[Jawab SATU(1) soalan sahaja]

Question 5

[Soalan 5]

- (a) Define the clipper and clamper.
[Takrifkan pengetip dan pengapit.]

(3 Marks/ Markah)

- (b) Based on Figure 5.
[Berdasarkan pada Rajah 5]

- (i) Calculate the output voltage, V_o .
[kirakan voltan keluaran, V_o .]

(3 Marks/ Markah)

- (ii) Sketch and label the output voltage, V_o .
[Lakar dan labelkan voltan keluaran, V_o .]

(4 Marks/ Markah)

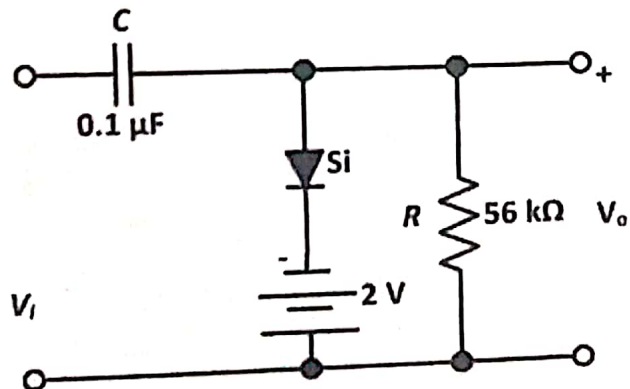
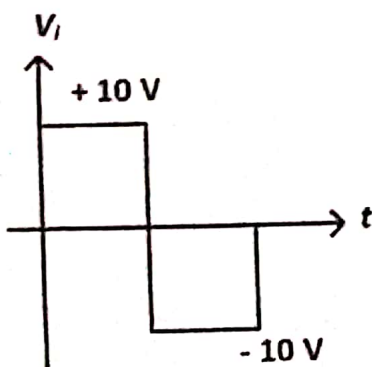


Figure 5
[Rajah 5]

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-2.07
1.02 = 2.07

(c) **Figure 6** is a BJT biasing circuit. By assuming $\alpha_{DC} = 0.98$. Solve:
 [Rajah 6 adalah suatu BJT terpinang. Anggapkan $\alpha_{DC} = 0.98$. Selesaikan:]

(i) emitter voltage, V_E .
 [Kirakan voltan pemancar, V_E .]

$V_E = V_{BB} - V_{BE}$ (2 Marks/ Markah)

(ii) emitter current, I_E .
 [Tentukan arus pemancar, I_E .]

(2 Marks/ Markah)

(iii) collector current, I_C .
 [Selesaikan arus pemungut, I_C .]

(2 Marks/ Markah)

(iv) base current, I_B .
 [Kirakan arus tapak, I_B .]

(2 Marks/ Markah)

(v) β_{DC} .
 [β_{DC} .]

(2 Marks/ Markah)

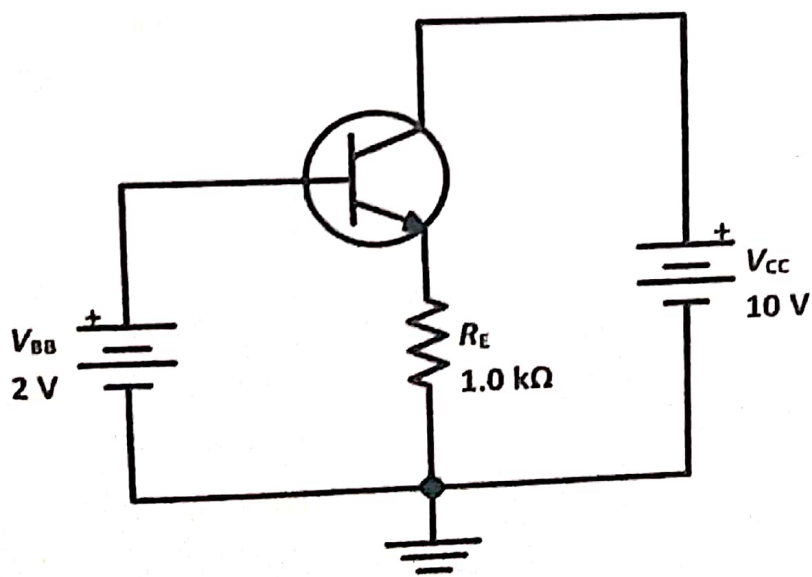


Figure 6
 [Rajah 6]

Question 6

[Soalan 6]

(a) Compare application of clipper and clamper circuits.
 [Bandingkan aplikasi litar pengetip dan pengapit]

(3 Marks/ Markah)

(b) Based on Figure 7.
 [Berdasarkan Rajah 7]

(i) determine the peak forward current, I_F through each diode.
 [tentukan arus puncak hadapan, I_F melalui setiap diod]

(3 Marks/ Markah)

(ii) sketch and label the output voltage waveform for each circuit.
 [lakar dan labelkan bentuk gelombang voltan keluaran bagi setiap litar]

(4 Marks/ Markah)

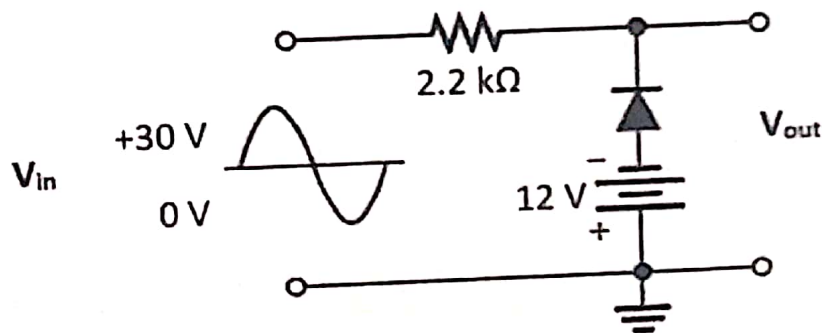


Figure 7
 [Rajah 7]

KVL

$$(-12 - 0.7) - I(2.2k) = 0$$

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(c) By assuming $\beta = 100$ and based on Figure 8, solve:
[Andaikan $\beta = 100$ dan berdasarkan pada Rajah 8, selesaikan.]

- (i) Collector current during saturation, $I_{C(sat)}$
[Arus pengumpul semasa tepu, $I_{C(sat)}$] (2 Marks/ Markah)
- (ii) Voltage between collector and emitter during cutoff, $V_{CE(cutoff)}$
[Voltan antara pengumpul dan pemancar semasa putus, $V_{CE(cutoff)}$] (2 Marks/ Markah)
- (iii) Base current at q-point, I_{BQ} $= \frac{I_{CQ}}{\beta} = \frac{V_{CC} - V_{CEQ}}{R_C \beta}$
[Arus tapak, I_{BQ}] (2 Marks/ Markah)
- (iv) Collector current at q-point, I_{CQ}
[Arus pengumpul, I_{CQ}] (2 Marks/ Markah)
- (v) Voltage between collector and emitter q-point, V_{CEQ}
[Voltan antara pemungut dan pengumpul, V_{CEQ}] (2 Marks/ Markah)

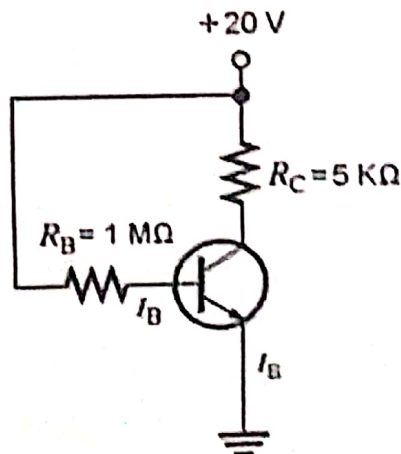


Figure 8
[Rajah 8]

$$\rightarrow I_B = \frac{V_{CC} - V_{BE}}{R_B}$$