

**SULIT**



**BAHAGIAN PEPERIKSAAN DAN PENILAIAN  
JABATAN PENDIDIKAN POLITEKNIK  
KEMENTERIAN PENDIDIKAN TINGGI**

**JABATAN KEJURUTERAAN ELEKTRIK**

**PEPERIKSAAN AKHIR  
SESI DISEMBER 2016**

**DEE2023: SEMICONDUCTOR DEVICES**

**TARIKH : 04 APRIL 2017  
MASA : 2.30 PM – 4.30 PM ( 2 JAM)**

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Kertas ini mengandungi **DUABELAS (12)** halaman bercetak.  
Bahagian A : Objektif (10 soalan)  
Bahagian B : Struktur (4 soalan)  
Bahagian C : Esei (2 soalan)  
Dokumen sokongan yang disertakan : Tiada

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**JANGAN BUKA KERTAS SOALAN INI SEHINGGA DIARAHKAN**

(CLO yang tertera hanya sebagai rujukan)

**SULIT**

**SECTION A : 10 MARKS**  
**BAHAGIAN A : 10 MARKAH**

**INSTRUCTION:**

This section consists of **TEN (10)** objective questions. Mark your answers in the OMR form provided.

**ARAHAN:**

*Bahagian ini mengandungi **SEPULUH (10)** soalan objektif. Tandakan jawapan anda di dalam borang OMR yang disediakan.*

CLO1  
C1

1. The p-type semiconductor is produced by doping \_\_\_\_\_ atoms into a pure semiconductor.

*Separuh pengalir jenis- p dihasilkan melalui pendopanan atom \_\_\_\_\_ ke dalam separuh pengalir tulen.*

- A. Tetravalence / *tetravalens*
- B. Electrovalence / *elektrovalens*
- C. Pentavalence / *pentavalens*
- D. Trivalence / *trivalens*

CLO1  
C2

2. A P-N junction acts as a closed switch when it \_\_\_\_\_.

*Simpang P-N menjadi seperti suis tertutup apabila ia \_\_\_\_\_.*

- A. cannot overcome its barrier voltage  
*tidak boleh melepasi voltan sawar*
- B. has a wide depletion region  
*mempunyai kawasan susutan yang luas*
- C. is reversed biased  
*dipincang balikan*
- D. has a low junction resistance  
*mempunyai rintangan simpang yang rendah*

CLO1  
C1

3. Figure A(3) as shown below represents an output waveform where  $t_0$  to  $t_1$  is representing the output waveform of positive half-cycle, while  $t_1$  to  $t_2$  is representing the output waveform of the negative half-cycle. Identify the correct circuit which can generate the waveform.

Rajah A(3) seperti yang ditunjukkan di bawah merupakan satu bentuk gelombang keluaran yang mana  $t_0$  hingga  $t_1$  mewakili gelombang keluaran positif setengah kitaran, manakala  $t_1$  hingga  $t_2$  mewakili gelombang keluaran separuh kitaran negatif. Kenal pasti litar yang betul yang boleh menjana gelombang tersebut.

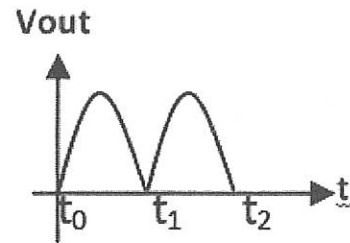
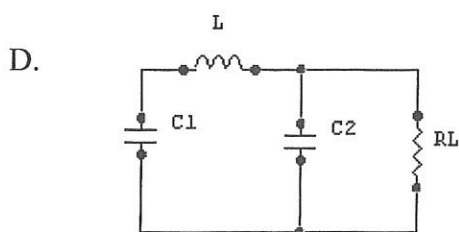
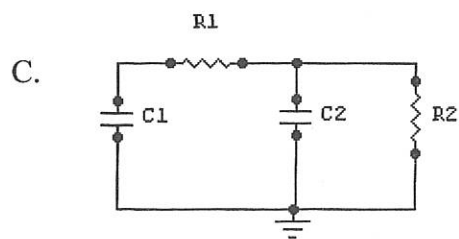
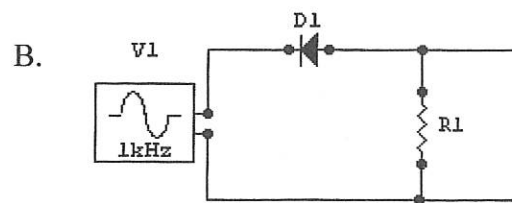
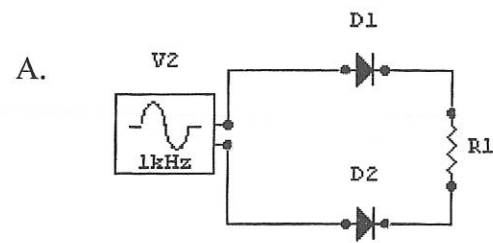


Figure A(3)  
Rajah A(3)



CLO2  
C3

4. In the full-wave rectifier circuit in figure A(4), the transformer primary winding is connected across an AC source of 230V (rms), 50Hz. For this circuit, calculate the DC output voltage.

Dalam litar penerus gelombang penuh bagi rajah A(4), gelung pengubah utama disambungkan menerusi sumber AU 230V (rms), 50Hz. Bagi litar ini, kirakan voltan keluaran AT.

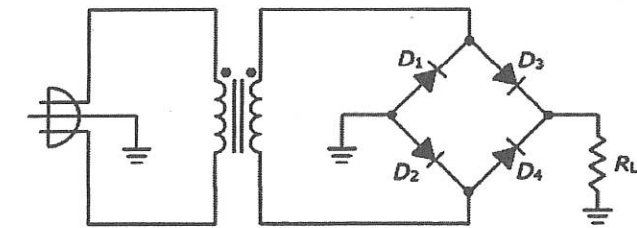


Figure A(4)  
Rajah A(4)

- A. 230V
- B. 460V
- C. 207V
- D. 325V

CLO1  
C1

5. The meaning of DC Operating Point (Q-Point) is .....

Maksud Titik Operasi AT (Q-Point) adalah .....

A. The saturation currents and voltages that are present at the terminals of device when DC supplies are connected to it.

Arus dan voltan tepu yang terdapat di terminal peranti apabila bekalan AT disambungkan kepadanya.

B. The breakdown currents and voltages that are present at the terminals of device when DC supplies are connected to it

Arus dan voltan pecahtebat yang terdapat di terminal peranti apabila bekalan AT disambungkan kepadanya

C. The quiescent (or idle) currents and voltages that are present at the terminals of device when DC supplies are connected to it.

Arus dan voltan tenang yang terdapat di terminal peranti apabila bekalan AT disambungkan kepadanya.

D. The load currents and voltages that are present at the terminals of device when DC supplies are connected to it

Arus dan voltan beban yang wujud pada terminal peranti apabila bekalan AT disambungkan.

CLO2  
C3

6.

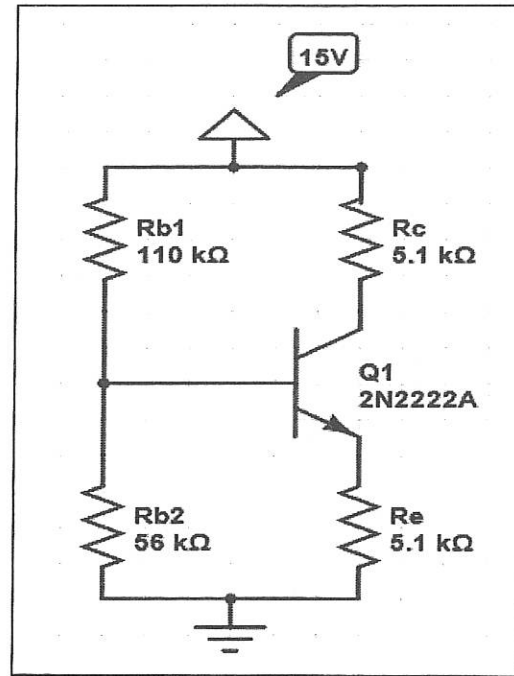


Figure A(6)  
Rajah A(6)

Referring to Figure A(6), given  $R_{b1}=110\text{ k}\Omega$ ,  $R_{b2}=56\text{ k}\Omega$ ,  $R_c=5.1\text{ k}\Omega$ ,  $R_e=5.1\text{ k}\Omega$  and  $V_{cc}=15\text{V}$ , calculate the value for  $I_{C(sat)}$ .

Merujuk Rajah A(6), diberi  $R_{b1}=110\text{ k}\Omega$ ,  $R_{b2}=56\text{ k}\Omega$ ,  $R_c=5.1\text{ k}\Omega$ ,  $R_e=5.1\text{ k}\Omega$  dan  $V_{cc}=15\text{V}$ , kira nilai  $I_{C(sat)}$ .

- A. 14.7mA
- B. 147mA
- C. 1.47mA
- D. 1.47nA

CLO1  
C2

7.

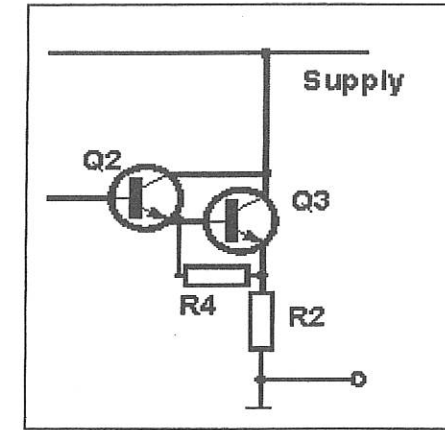


Figure A(7)  
Rajah A(7)

Referring to the circuit in Figure A(7), name the circuit.

Merujuk kepada litar dalam Rajah A(7), namakan litar tersebut.

- A. The CE-CC configuration  
Konfigurasi CE-CC
- B. The Darlington Pair  
Pasangan Darlington
- C. RC Coupling circuit  
Litar penjodoh RC
- D. The bypass capacitor  
Pemuat pintasan

CLO1  
C1

8. A JFET always operates when .....

JFET sentiasa beroperasi apabila .....

- A. The gate to source pn junction reverse-biased  
Get ke punca simpang pn dalam pincang songsang
- B. The gate to source pn junction forward-biased  
Get ke punca simpang pn dalam pincang depan
- C. The drain connected to ground  
Salur disambungkan ke bumi
- D. The gate connected to the source  
Get disambungkan ke punca

CLO1  
C2

9. In JFET, electric charge flow through a semiconducting channel between \_\_\_\_\_ and \_\_\_\_\_ terminal.

*Dalam JFET, cas elektrik mengalir melalui saluran separapengalir di antara terminal \_\_\_\_\_ dan \_\_\_\_\_*

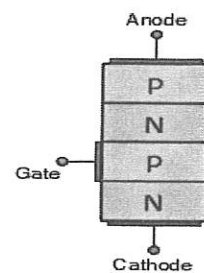
- A. Source, drain  
*Punca, salur*
- B. Gate, source  
*Get, punca*
- C. Gate, drain  
*Get, salur*
- D. Source, gate  
*Punca, get*

CLO1  
C1

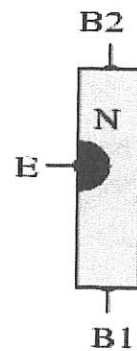
10. Which physical structure represent DIAC?

*Struktur fizikal manakah yang mewakili DIAK?*

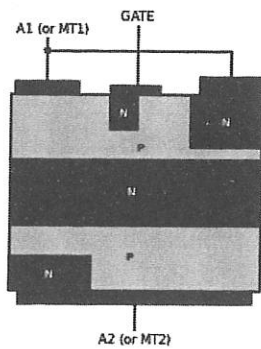
A.



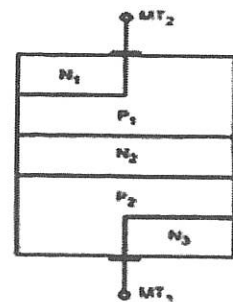
B.



C.



D.



**SECTION B : 60 MARKS**  
**BAHAGIAN B : 60 MARKAH**

**INSTRUCTION:**

This section consists of **FOUR (4)** structured questions. Answer **ALL** questions.

**ARAHAN:**

*Bahagian ini mengandungi EMPAT (4) soalan berstruktur. Jawab semua soalan.*

**QUESTION 1**

**SOALAN 1**

CLO1  
C1

a) List down **THREE (3)** types of material that are classified in semiconductor's family.

*Senaraikan TIGA (3) jenis bahan yang tergolong dalam keluarga semikonduktor.*

[3 marks]

[3 markah]

CLO1  
C2

b) Differentiate **TWO (2)** between N-Type material and P-Type material.

*Bezakan DUA (2) di antara bahan jenis N dan bahan jenis P.*

[5 marks]

[5 markah]

CLO2  
C3

c) Discuss the operation of forward biased and the effect of depletion layer.

*Bincangkan operasi bagi pincang hadapan dan kesannya ke atas lapisan susutan.*

[7 marks]

[7 markah]

## QUESTION 2

## SOALAN 2

CLO1  
C1

- a) State **TWO (2)** types of Field Effect Transistor (FET)

*Nyatakan DUA (2) jenis Transistor Kesan Medan*

[3 marks]  
[3 markah]

CLO2  
C2

- b) Describe briefly the construction of a MOSFET in enhancement mode.

*Huraikan dengan jelas binaan MOSFET bagi mod-enhancement.*

[5 marks]  
[5 markah]

CLO2  
C3

- c) Relate **ONE (1)** similarities and **TWO (2)** differences between JFET and MOSFET.

*Huraikan SATU (1) persamaan dan DUA (2) perbezaan diantara JFET dan MOSFET.*

[7 marks]  
[7 markah]

## QUESTION 3

## SOALAN 3

CLO1  
C2

- a) Describe multistage amplifier.

*Terangkan penguat pelbagai peringkat.*

[3 marks]  
[3 markah]

CLO2  
C3

- b) Using a suitable diagram, illustrate the operation of Darlington Pair.

*Dengan menggunakan gambarajah yang sesuai, ilustrasikan operasi litar Darlington Pair.*

[6 marks]  
[6 markah]

CLO2  
C3

- c) Based on the Figure B3(c), calculate the gain of second stage ( $A_2$ ), input voltage at the first stage ( $V_1$ ) and overall voltage gain in dB if the output at the first stage ( $V_2$ ) is  $0.2V_{rms}$  and the output voltage at the second stage ( $V_3$ ) is  $4V_{rms}$ .

*Merujuk kepada Rajah B3(c), kirakan gandaan pada peringkat kedua ( $A_2$ ), voltan masukan pada peringkat pertama ( $V_1$ ) dan voltan gandaan keseluruhan dalam dB jika voltan keluaran pada peringkat pertama ( $V_2$ ) adalah  $0.2V_{rms}$  dan voltan keluaran pada peringkat kedua ( $V_3$ ) adalah  $4V_{rms}$ .*

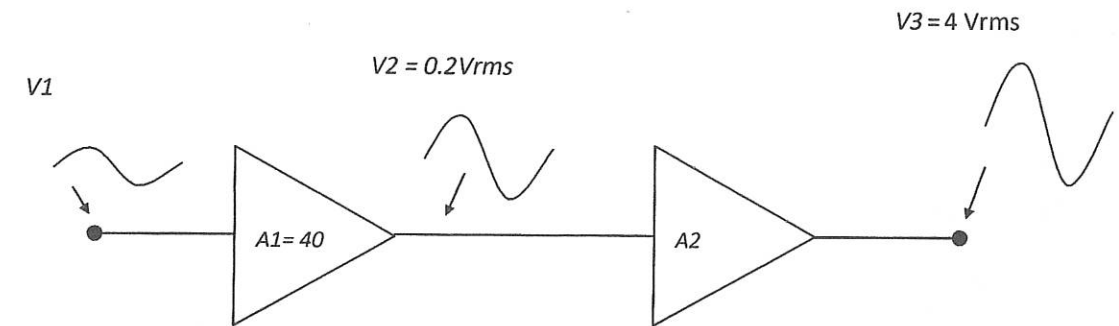


Figure B3(c) / Rajah B3(c)

[6 marks]  
[6 markah]

## QUESTION 4

## SOALAN 4

CLO1  
C1

- a) List **THREE (3)** other electronic devices  
*Senaraikan TIGA (3) peranti elektronik yang lain*

[3 marks]  
[3 markah]

CLO1  
C3

- b) Sketch the symbol of SCR and relate **TWO (2)** its applications.  
*Lakarkan symbol SCR dan nyatakan DUA (2) kegunaannya.*

[5 marks]  
[5 markah]

CLO2  
C3

- c) Draw the graph for I-V characteristic of SCR  
*Lukis bagi graf ciri I-V untuk SCR*

[7 marks]  
[7 markah]

**SECTION C : 30 MARKS**  
**BAHAGIAN C : 30 MARKAH**

**INSTRUCTION:**

This section consists of **TWO (2)** essay questions. Answer **ALL** questions.

**ARAHAN:**

Bahagian ini mengandungi **DUA (2)** soalan esei. Jawab **semua** soalan.

CLO2  
C3

**QUESTION 1**  
**SOALAN 1**

Referring to the common emitter circuit in Figure C1, if the transistor used is silicon. Calculate the value of  $I_B$ ,  $I_C$ ,  $V_{CQ}$ ,  $I_C$  (saturation) and  $V_c$  (cut off). Given  $V_{BE} = 0.7V$  and  $\beta = 50$ .

Dengan merujuk kepada litar pemancar sepunya di Rajah C1, transistor yang digunakan adalah silikon. Tentukan nilai bagi  $I_B$ ,  $I_C$ ,  $V_{CQ}$ ,  $I_C$  (tepu) and  $V_c$  (potong). Diberi  $V_{BE} = 0.7V$  dan  $\beta = 50$ .

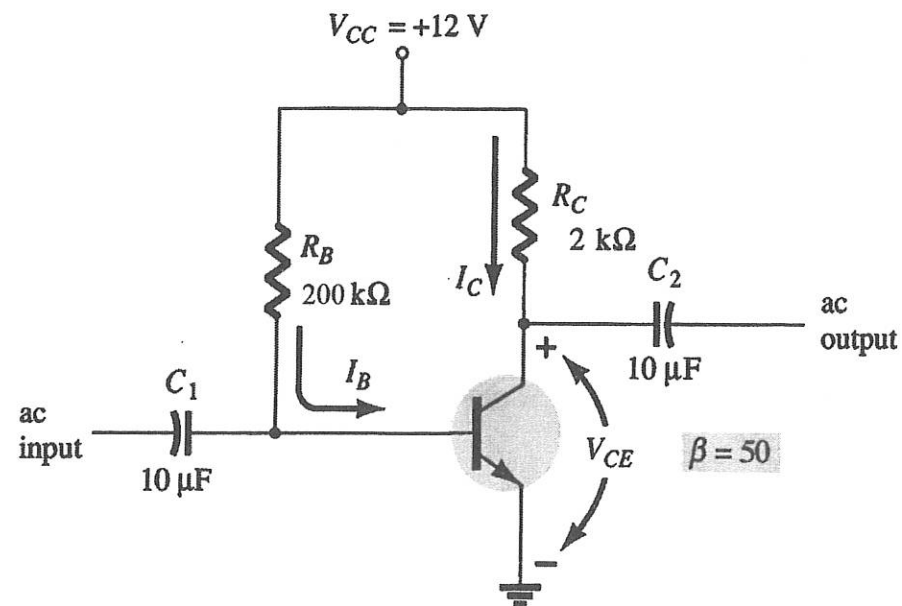


Figure C1 / Rajah C1

[15 marks]  
 [15 markah]

**QUESTION 2**  
**SOALAN 2**

CLO2  
C3

By using a suitable diagram, illustrate the operation of a two diode full-wave rectifier circuit in detail.

Dengan menggunakan gambarajah yang bersesuaian, ilustrasikan dengan jelas operasi penerus gelombang penuh dua diod.

[15 marks]  
 [15 markah]

**SOALAN TAMAT**