SULIT

BAHAGIAN PEPERIKSAAN DAN PENILAIAN
JABATAN PENDIDIKAN POLITEKNIK
KEMENTERIAN PENDIDIKAN TINGGI

JABATAN KEJURUTERAAN ELEKTRIK

PEPERIKSAAN AKHIR

SESI DISEMBER 2017

DEE2023 : SEMICONDUCTOR DEVICES

TARIKH : 05 APRIL 2018
MASA : 8.30 PAGI - 10.30 PAGI (2 JAM)

Kertas ini mengandungi **SEPULUH (10)** halaman bercetak.

Bahagian A: Objektif (10 soalan)
Bahagian B: Struktur (4 soalan)
Bahagian C: Esei (2 soalan)

Dokumen sokongan yang disertakan : Tiada

JANGAN BUKA KERTAS SOALAN INI SEHINGGA DIARAHKAN

(CLO yang tertera hanya sebagai rujukan)

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. Which of the following statements explain the term of semiconductor?
Pernyataan manakah yang menerangkan tentang istilah separuh pengalir?

   A. Material that behaves in between a conductor and insulator.
   Bahan yang bersifat antara pengalir dan penebat.

   B. Contains five electron valences in its valence layer.
   Mengandungi lima elektron valens di lapisan valensnya.

   C. Cannot conduct an electrical current.
   Tidak boleh mengalirkan arus elektrik.

   D. The atom becomes very stable in high temperature.
   Atom menjadi sangat stabil dalam suhu yang tinggi.

CLO1
C2

2. Referring to the circuit in **Figure A2**, choose the correct statement.
*Merujuk kepada **Rajah A2**,pilih pernyataan yang betul.*

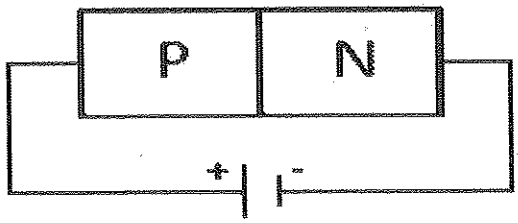


Figure A2/ *Rajah A2*

   A. Electron in N-type will be pushed towards the negative supply.
   Elektron dalam bahan-N akan tertolak ke sumber bekalan negatif.

   B. Resistance of P-N junction increases.
   Rintangan simpang P-N akan meningkat.

   C. Depletion region become thick.
   Kawasan kesusutan menjadi tebal.

   D. Current can flow easily.
   Arus akan mengalir dengan mudah

CLO1
C1

3. A diode conducts when it is forward-biased, and the anode is connected to the _____ through a limiting resistor.
Diod beroperasi apabila dalam keadaan pincang-hadapan dan anod disambungkan kepada _____ melalui perintang pengehad.

A. positive supply
bekalan positif

B. negative supply
bekalan negatif

C. cathode
katod

D. anode
anod

CLO1
C1

4. An n-type semiconductor material _____.
Bahan semikonduktor jenis-n _____.

A. is intrinsic
adalah intrinsik

B. has trivalent impurity atoms added.
mempunyai tiga elektron valen tidak tulen ditambah.

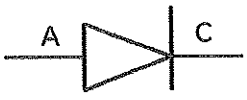
C. has pentavalent impurity atoms added
mempunyai lima elektron valen tidak tulen ditambah

D. requires no doping
tidak memerlukan doping

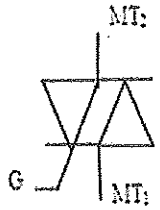
CLO2
C3

5. Identify the schematic symbol for Bipolar Junction Transistor (BJT).
Kenalpasti simbol skematik untuk Bipolar Junction Transistor (BJT.)

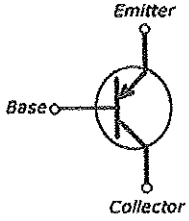
A.



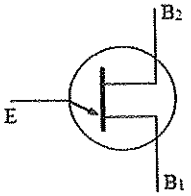
C.



B.



D.



CLO1
C2

6. Referring to the **Figure A6**, if Beta factor of the silicon transistor is 120, calculate Ic (sat).
*Rujuk kepada **Rajah A6**, jika faktor Beta transistor silikon 120, kira Ic(sat).*

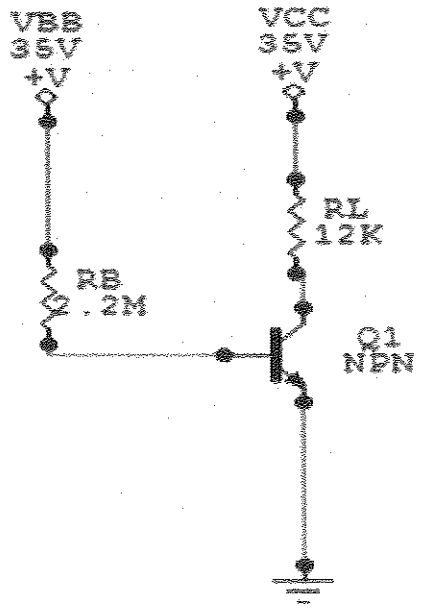


Figure A6 / *Rajah* A6

A. 15.6 µA
B. 1.87 mA
C. 2.92 µA
D. 2.92 mA

CLO1
C1

7. Calculate a certain multistage amplifier that has an open-loop voltage gain of 130000 in dB.
Kirakan nilai gandaan satu penguat pelbagai peringkat yang mempunyai gandaan voltan gelung buka sebanyak 130,000 dalam dB.

A. 51.1dB
B. 102.3dB
C. 130,000dB
D. 10.35dB

CLO2
C2

8. I_{DSS} is known as _____.
I_{DSS} adalah dikenali sebagai _____.

A. The drain current with the source shorted
Arus "drain" dengan "source" dipintaskan.

B. The drain current at cutoff
Arus "drain" semasa "cutoff"

C. The maximum possible drain current
Maksimum arus "drain" yang boleh mengalir dalam litar.

D. The midpoint drain current
Titik tengah arus "drain"

CLO1 C2

9. If the JFET has $V_{GS(off)} = -4V$, what is the value of the pinch-off voltage, V_P?
Jika JFET mempunyai $V_{GS(off)} = -4V$, apakah nilai voltan "pinch-off", V_P?

A. Cannot be determined
Tidak dapat ditentukan

B. -4V
-4V

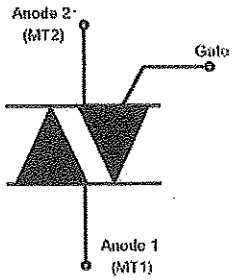
C. Depends on V_{GS}
Bergantung pada nilai V_{GS}

D. +4V
+4V

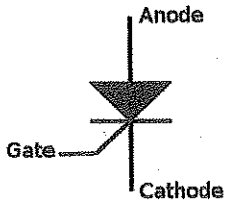
CLO1 C1

10. Identify the schematic symbol for Triode For Alternating Current.
Kenalpasti simbol skematik bagi Triode For Alternating Current.

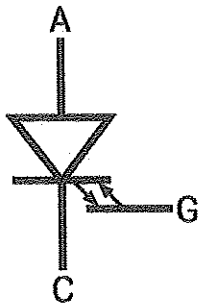
A.



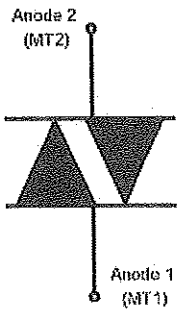
B.



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 **TWO (2)** semiconductor materials.

*Senaraikan **DUA (2)** bahan semikonduktor.*

[3 marks]

[*3 markah*]

CLO1
C2

b) Describe **FIVE (5)** characteristics of P-type semiconductors.

*Terangkan **LIMA (5)** ciri semikonduktor jenis P.*

[5 marks]

[*5 markah*]

CLO2
C3

c) Illustrate forward biased voltage and reverse biased voltage supplied across a P-N junction.

Ilustrasikan voltan pincang hadapan dan voltan pincang balikan dengan simpang P-N.

[7 marks]

[*7 markah*]

QUESTION 2

SOALAN 2

CLO1
C1

a) Draw the schematic symbol for N-channel of EMOSFET and N-channel of DMOSFET.

Lukis skematik simbol bagi saluran-N EMOSFET dan saluran-N DMOSFET.

[3 marks]

[*3 markah*]

CLO2
C2

b) Describe the operating region of JFET at ohmic region and saturation region.

Terangkan kawasan kendalian JFET di kawasan ohm dan kawasan tepu.

[5 marks]

[*5 markah*]

CLO2
C3

c) Sketch the complete I-V characteristics of an N-channel JFET with the gate short-circuit to the source.

Lukiskan lengkuk ciri-ciri IV yang lengkap bagi saluran-N JFET dengan pintu dilintar pintas kepada punca.

[7 marks]

[*7 markah*]

QUESTION 3

SOALAN 3

CLO1
C2

a) Explain **TWO (2)** basic feedback concepts in multistage amplifier.
*Terangkan **DUA (2)** konsep asas maklum balas dalam penguat berbilang.*

[3 marks]
[*3 markah*]

CLO2
C3

b) Draw the circuit for transformer coupling configuration and explain **TWO (2)** advantages of transformer coupling.
*Lukiskan litar untuk konfigurasi gandingan pengubah dan jelaskan **DUA(2)** kelebihan pengubah gandingan.*

[6 marks]
[*6 markah*]

CLO2
C3

c) For multistage amplifier, Stage 1 has an input voltage, V_{in1} = 20mV and an output voltage, V_{out1} = 1V. For Stage 2 has an output voltage V_{out2} = 10V.Calculate the voltage gains, AV1, AV2 and total gain, A_{VT}
Bagi penguat berbilang, Peringkat 1 mempunyai voltan input, V_{in1} = 20mV dan voltan keluaran, V_{out1} = 1V. Bagi Peringkat 2 mempunyai voltan keluaran V_{out2} = 10V.Kirakan gandaan voltan, A_{V1} , A_{V2} dan jumlah gandaan voltan, A_{VT}

[6 marks]
[*6 markah*]

QUESTION 4

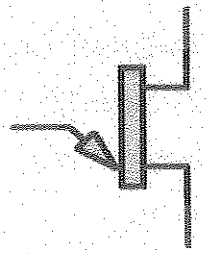
SOALAN 4

CLO1
C1

(a) Label the terminal numbered 1, 2, 3 for Unijunction Transistor (UJT) below.

Labelkan terminal bernombor 1, 2, 3 untuk Transistor Eka Simpang (UJT) di bawah.

2. .....



1. .....

3. ..... [3 marks]

[3 markah]

CLO1
C3

(b) Construct the application circuit for DIAC to trigger TRIAC

Bina litar kegunaan DIAC untuk memicu TRIAK

[5 marks]

[5 markah]

CLO2
C3

(c) Illustrate the I-V characteristic curve for SCR

Ilustrasikan lengkuk 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.*

QUESTION 1

SOALAN 1

CLO2
C3

Illustrate the **TWO (2)** circuit diagram with input and output of diode as a limiter circuit.

*Ilustrasikan **DUA(2)** rajah litar dengan masukan dan keluaran bagi diod sebagai litar penghad.*

[15 marks]

[*15 markah*]

QUESTION 2

SOALAN 2

CLO2
C3

With aid of diagram, demonstrate the I-V characteristics of Regular Diode and Zener Diode.

Dengan bantuan gambarajah, jelaskan ciri I-V bagi kedua-dua jenis diod iaitu Diod Biasa dan Diod Zener.

[15 marks]

[*15 markah*]

SOALAN TAMAT