9

POLITEKNIK MALAYSIA

BAHAGIAN PEPERIKSAAN DAN PENILAIAN
JABATAN PENGAJIAN POLITEKNIK
KEMENTERIAN PENDIDIKAN MALAYSIA

JABATAN KEJURUTERAAN ELEKTRIK

PEPERIKSAAN AKHIR

SESI DISEMBER 2013

EE201: SEMICONDUCTOR DEVICES

TARIKH : 14 APRIL 2014
TEMPOH : 8.30 -10.30 AM (2 JAM)

Kertas ini mengandungi **LAPAN BELAS (18)** halaman bercetak.
Bahagian A: Objektif (20 soalan)
Bahagian B: Struktur (10soalan)
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 : 20 MARKS
BAHAGIAN A : 20 MARKAH

INSTRUCTION:
This section consists of **TWENTY (20)** objective questions. Mark your answers in the OMR form provided.

ARAHAN :
*Bahagian ini mengandungi **DUA PULUH (20)** soalan objektif. Tandakan jawapan anda di dalam borang OMR yang disediakan.*

CLO1 C1

1 Define a semiconductor in its pure form.

Tentukan separuh pengalir dalam bentuk tulin.

A. Intrinsic semiconductor
Separuh pengalir Intrinsik

B. Extrinsic semiconductor
Separuh pengalir Ekstrinsik

C. P-type semiconductor
Separuh pengalir jenis p

D. N-type semiconductor
Separuh pengalir jenis n

CLO1 C2

2. The purpose of a pentavalent impurity is to

Kegunaan bendasing yang mempunyai lima elektron valensi ialah untuk

A. Reduce the conductivity of semiconductor
Mengurangkan pengaliran elektrik separa pengalir

B. Increase the number of holes
Meningkatkan bilangan lubang

C. Increase the number of free electrons
Meningkatkan bilangan elektron-elektron bebas

D. Create minority carriers
Mewujudkan pembawa minoriti

CLO2
C2

3. Diode resistance is very large and it does not allow current to flow through it. This state indicates the diode is_____.

Rintangan diod adalah sangat tinggi dan menghalang arus mengalir melaluinya. Ini menunjukkan diod dalam keadaan _____.

A. a good diode
Diod baik

B. an open diode
Diod terbuka

C. a shorted diode
Diod terpintas

D. a saturated diode
Diod tepu

CLO1
C2

4. Which of the following diode is operated in reverse bias mode ?

Antara diod berikut yang manakah dikendalikan dalam keadaan pincang songsang?

A. P-N Junction
Simpang P-N

B. Zener diode
Diod Zener

C. Tunnel
Terowong

D. Schottky
Schottky

CLO1
C3

5. Figure A5 shows the clipper circuit in series with biased. Which of the following is the correct output for this circuit?

Rajah A5 menunjukkan litar penghad siri. Antara yang berikut yang manakah keluaran litar yang betul?

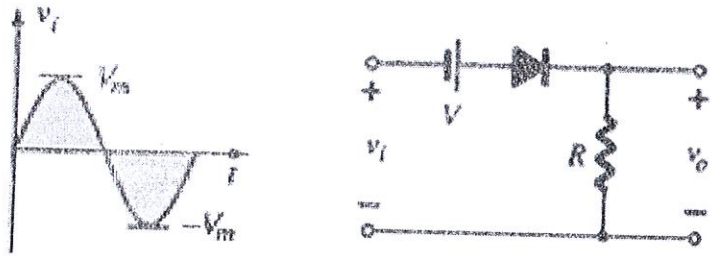
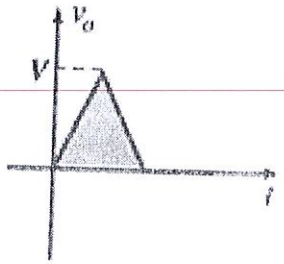
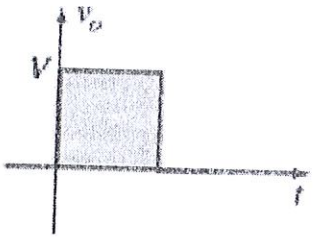


Figure A5/ *Rajah A5*

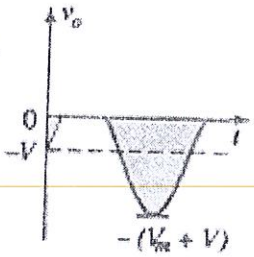
A.



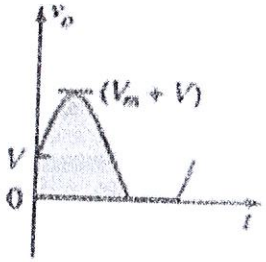
B.



C.



D.



CLO1 C2

6 Match the function of a photodiod.

Padankan fungsi bagi fotodiod.

A. As a regulator / *sebagai pengatur*

B. As an indicator / *sebagai penanda*

C. As a light detector / *sebagai pengesan cahaya*

D. As a temperature sensor / *sebagai sensor suhu*

CLO1 C2

7 Select the beta current ratio.

Pilih nisbah arus beta.

A. I_E / I_B

B. I_B / I_E

C. I_C / I_E

D. $? / I_B$

CLO1 C2

8 Identify the function of an emitter resistor C-E configuration :

Kenalpasti fungsi perintang pengeluar dalam konfigurasi C-E :

A. AC Signal bypass
Isyarat pirau A.U

B. Collector bias
Pincang Pemungut

C. Higher gain
Gandaan Tertinggi

D. Stabilization
Penstabilan

CLO2
C2

9 The configuration of transistor in Figure A10 is

Sambungan transistor di dalam Rajah A1 ialah

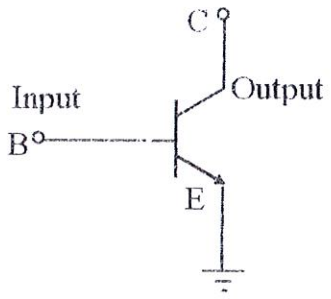


Figure A9 / *Rajah A9*

A. Common Base Configuration
Sambungan Tapak Sepunya

B. Common Collector Configuration
Sambungan Pemungut Sepunya

C. Common Emitter Configuration
Sambungan Pemancar Sepunya

D. Common Common Configuration
Sambungan Sepunya Sepunya

CLO1
C1

10

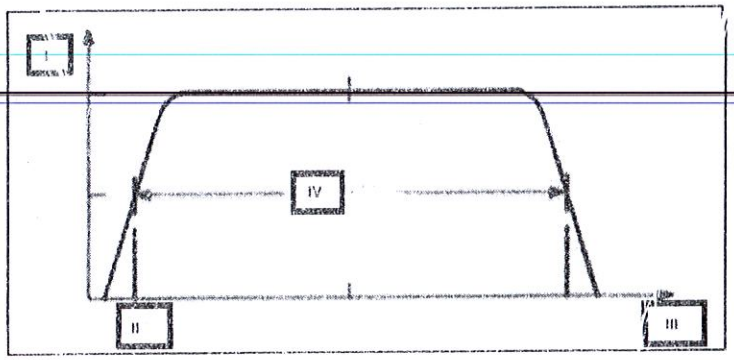


Figure A10 / Rajah A10

Based on the frequency response curve in Figure A1, match the numbering with the correct parameter.

Berdasarkan lengkung sambutan frekuensi pada Rajah 1, suaipadan nombor dengan parameter yang betul.

	I	II	III	IV
A.	Frequency *Frekuensi*	Bandwidth *Jalur lebar*	Lower cut-off frequency *Frekuensi potongan rendah*	Gain *Gandaan*
B.	Bandwidth *Jalur lebar*	Upper cut-off frequency *Frekuensi potongan tinggi*	Gain *Gandaan*	Frequency *Frekuensi*
C.	Gain *Gandaan*	Lower cut-off frequency *Frekuensi potongan rendah*	Frequency *Frekuensi*	Bandwidth *Jalur lebar*
D.	Upper cut-off frequency *Frekuensi potongan tinggi*	Gain *Gandaan*	Bandwidth *Jalur lebar*	Frequency *Frekuensi*

CLO1
C3

11 How many amplifiers are required to implement this equation, $V_{out} = V_1 \times V_2$.

Untuk penguat pelbagai peringkat, berapa banyak penguat yang diperlukan untuk melaksanakan persamaan $V_{out} = V_1 \times V_2$.

A. 2

B. 1

C. 3

D. 4

CLO1
C2

12 Based on **Figure A13** , name the circuit.

Berdasarkan kepada ***Rajah A13****, namakan litar berkenaan.*

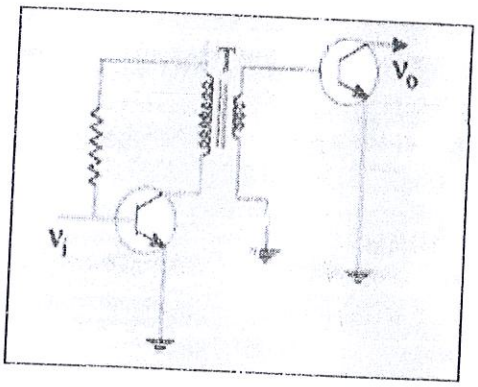


Figure A12/ *Rajah A12*

A. Darlington Pair / *Pasangan Darlington*

B. Transformer Coupling / *Gandingan Pengubah*

C. Direct Coupling / *Gandingan Terus*

D. RC Coupling / *Gandingan RC*

CLO2
C2

13 A certain multistage amplifier has an open-loop voltage gain of 150,000. Express this gain in dB?

Satu penguat pelbagai peringkat mempunyai gandaan voltan gelung buka sebanyak 150,000. Nyatakan nilai gandaan ini dalam dB?

A. 51.7dB

B. 103.5dB

C. 150,000dB

D. 5.18dB

CLO2
C3

14. Diagram A15shows two stages amplifier connected in cascade. Calculate the input at the first stage (V_1) if the output at the third stage (V_3) is 32Vrms and that the voltage gain of each stage is $A_1 = A_2 = 40$.

Rajah A15 menunjukkan dua peringkat penguat disambung secara lata. Kira masukan pada peringkat pertama (V_1) jika keluaran kepada peringkat ketiga adalah 32Vrms dan gandaan voltan setiap peringkat adalah $A_1 = A_2 = 40$.

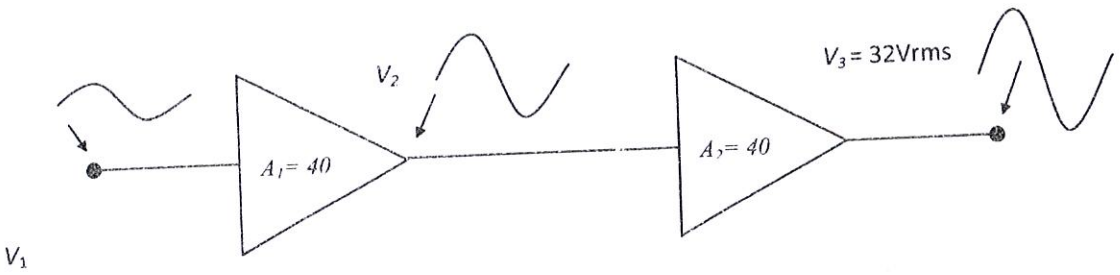


Diagram A14 / *Rajah A14*

A. 20mVrms

B. 1600Vrms

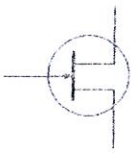
C. 32Vrms

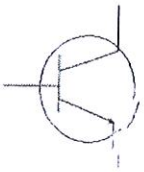
D. 3200Vrms

CLO1
C1

15. Which of the following is the schematic symbol of JFET?

Yang mana satukah simbol skematik untuk JFET?

A. 

B. 

C. 

D. 

CLO1
C1

16. Figure A17 shows the physical structure of :

Rajah A17 menunjukkan struktur fizikal untuk :

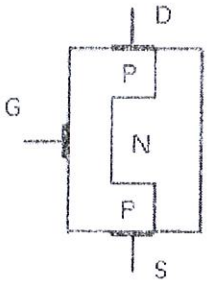


Figure 16 / *Rajah 16*

A. E-MOSFET, P-Channel
E-MOSFET, Saluran P

B. E-MOSFET, N-Channel
E-MOSFET, Saluran N

C. DE-MOSFET, P-Channel
DE-MOSFET, Saluran P

D. DE-MOSFET, N-Channel
DE-MOSFET, Saluran N

CLO1
C2

17. An E-MOSFET that operates at cutoff or in the ohmic region is an example of

MOSFET ragam peningkatan yang beroperasi pada keadaan potong atau kawasan ohmik ialah contoh

A. A three terminal device
Peranti pangkalan tiga

B. An active load
Beban aktif

C. A passive load
Beban pasif

D. A switching device
Peranti pensuisan

CLO1
C2

18. The SCR can be triggered on by a pulse at the

SCR boleh dipicu melalui denyut pada

A. Gate / *Get*

B. Anode / *Anod*

C. Cathode / *Katod*

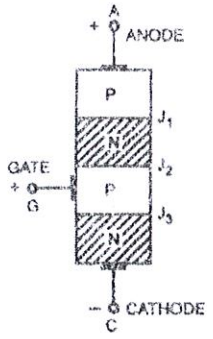
D. None of the above / *Tiada satu pun diatas*

CLO1
C1

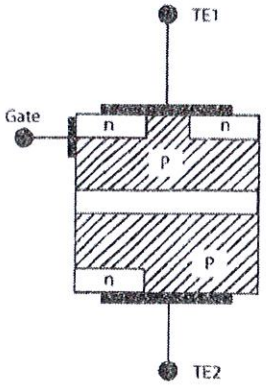
19. Which physical structure represent DIAC?

Yang manakah struktur fizikal yang mewakili DIAC?

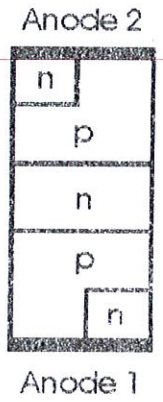
A



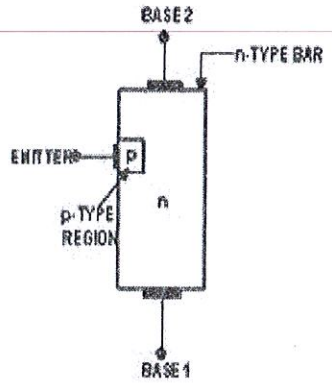
B



C



D



CLO2
C1

20 Figure A20 below shows an application of a DIAC. Identify the circuit.

Rajah A20 di bawah menunjukkan satu aplikasi Diak. Kenalpasti litar tersebut.

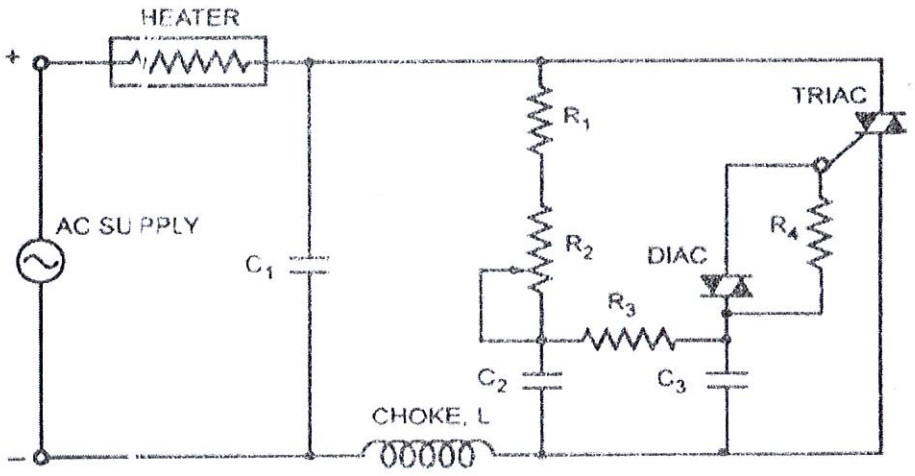


Figure A20 / *Rajah A20*

A. Lamp Dimmer / *Pemalap lampu*

B. Negative resistance / *Rintangan negatif*

C. Heat control / *Kawalan haba*

D. High-power lamp switch / *Suis lampu kuasa tinggi*

SECTION B : 30 MARKS
BAHAGIAN B : 30 MARKAH

INSTRUCTION:
This section consists of TEN (10) structured questions. Answer **ALL** questions.

ARAHAN:
Bahagian ini mengandungi SEPULUH (10) soalan berstruktur. Jawab semua soalan

CLO2
C3

QUESTION 1
With the aid of a diagram, sketch and label the atomic structure of copper (Cu) which has 29 atomic number.

SOALAN 1
Dengan bantuan gambarajah, lukis dan labelkan struktur atom bagi kuprum (Cu) yang mempunyai 29 nombor atom.

[3 marks]
[*3 markah*]

CLO 1
C1

QUESTION 2
Draw and label diode as full-wave rectifier

SOALAN 2
Lukis dan labelkan aplikasi bagi penerus gelombang penuh.

[3 marks]
[*3 markah*]

CLO1
C1

QUESTION 3
State THREE (3) advantages of LED in electronic circuit.

SOALAN 3
Nyatakan TIGA (3) kelebihan LED *dalam litar elektronik.*

[3 marks]
[*3 markah*]

CLO1
C1

QUESTION 4
Draw a schematic symbol for PNP and NPN transistor.

SOALAN 4
Lukiskan simbol skematik bagi transistor jenis PNP dan NPN.

[3 marks]
[*3 markah*]

CLO1
C2

QUESTION 5

Give the function of emitter resistance R_E, and shunt capacitor C_E, in common emitter amplifier circuit.

SOALAN 5

Berikan fungsi perintang pemancar R_E, dan kapasitor selari C_E, di dalam litar penguat pemancar sepunya.

[3 marks]
[*3 markah*]

CLO1
C3

QUESTION 6

Complete the following table

SOALAN 6

Lengkapkan jadual di bawah

	Vin	Vout	Av(dB)
a.	1mV	10V	80
b.	120μV	16V	
c.	5V	2.5V	-6.02
d.	14.4mV	14mV	

[3 marks]
[3 *markah*]

CLO1
C2

QUESTION 7

Describe the basic difference between a D-MOSFET and an E-MOSFET.

SOALAN 7

Terangkan perbezaan asas antara D-MOSFET dan E-MOSFET.

[3 marks]
[*3 markah*]

CLO2
C2

QUESTION 8

Differentiate between NMOS and PMOS.

SOALAN 8

Bandingkan di antara NMOS dan PMOS

[3 marks]
[*3 markah*]

CLO2
C2

QUESTION 9

State **TWO (2)** ways to stop an SCR operation.

SOALAN 9

*Nyatakan **DUA (2)** cara untuk menghentikan operasi SCR.*

[3 marks]
[*3 markah*]

CLO1 C1

QUESTION 10

List THREE (3) TRIAC applications in electronic circuit.

SOALAN 10

Senaraikan TIGA (3) kegunaan TRIAK di dalam litar elektronik

[3 marks]
[*3 markah*]

SECTION C : 50 MARKS
BAHAGIAN C : 50 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 C2

(a) Explain the meaning of reverse biased voltage supplied across a P-N junction. Draw the appropriate diagram.

Jelaskan maksud voltan pincang songsang yang dibekalkan merentasi simpang P-N. Lukiskan gambarajah yang sesuai

[5 marks]
[*5 markah*]

CLO2 C3

(b) There are TWO (2) types of biasing in a diode. By using a bulb, construct the schematic diagram and explain each of them accordingly.

Terdapat DUA (2) jenis pincangan bagi sebuah diod. Dengan menggunakan bulb bina gambarajah skematik yang sesuai dan terangkan.

[6 marks]
[*6 markah*]

CLO2 C2

(c) Illustrate a complete I-V characteristic curve for a diode.

Lakarkan dengan lengkap ciri lengkung I-V bagi sebuah diod.

[4 marks]
[*4 markah*]

CLO2 C3

(d) Calculate the following items for the Configuration of Figure C1. Given the value of $\beta = 212$ and VBE = 0.7 V.

Kirakan item- item di bawah bagi litar rajah C1. Diberi nilai of $\beta = 212$ dan VBE = 0.7 V.

i. I_B [3 marks] [3 *markah*]

ii. I_{CQ} [4 marks] [4 *markah*]

iii. V_{CE} [3 marks] [3 *markah*]

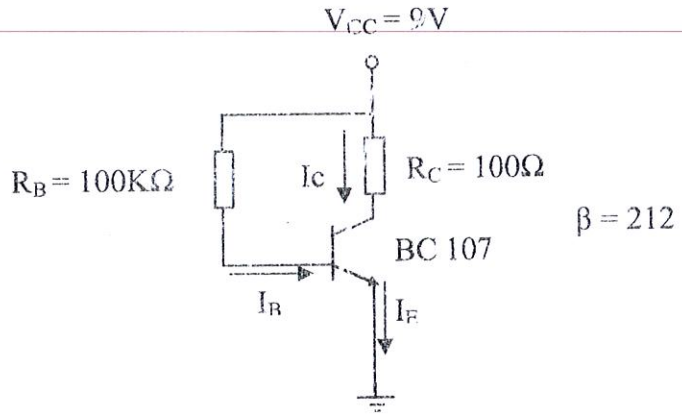


Figure C1
Rajah C1

QUESTION 2
SOALAN 2

CLO2 C1

(a) Define Multistage Amplifier
Takrifkan Penguat Pelbagai Peringkat [2 marks] [2 *markah*]

(b) By referring to Figure C2,
Dengan berpandukan Rajah C2,

CLO2 C2

i) Name the circuit network
Namakan litar berkenaan [1 mark] [1 *markah*]

CLO2
C2

ii) Give **TWO (2)** functions of the circuit network in (b) i)

*Berikan **DUA (2)** fungsi litar dalam (b) i)*

[2 marks]
[2 *markah*]

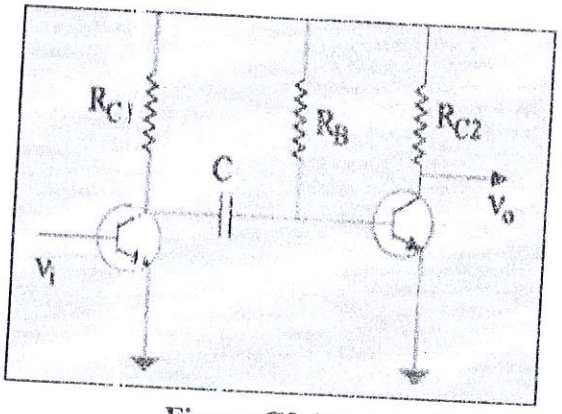


Figure C2 / *Rajah C2*

CLO2
C2

(c) With the aid of a diagram, explain the operation of Darlington Pair circuit.

Dengan menggunakan gambarajah, terangkan operasi litar bagi Pasangan Darlington.

[5 marks]
[5 *markah*]

CLO2
C2

(d) Using a suitable diagram, explain the operation in E-MOSFET.

Dengan menggunakan rajah yang bersesuaian, jelaskan kendalian E-MOSFET.

[10 marks]
[10 *markah*]

CLO2
C1

(e) Draw the physical structure of Silicon-Controlled Rectifier (SCR).

Lukiskan struktur fizikal untuk Silicon-Controlled Rectifier (SCR).

[5 marks]
[5 *markah*]

SOALAN TAMAT