

SULIT



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

JABATAN KEJURUTERAAN ELEKTRIK

PEPERIKSAAN AKHIR

SESI JUN 2016

ET502 : POWER ELECTRONICS

TARIKH : 25 OKTOBER 2016

TEMPOH : 2.30 PM – 4.30 PM (2 JAM)

Kertas ini mengandungi **TUJUH (7)** halaman bercetak.

Bahagian A : Struktur (10 soalan)

Bahagian B : Esei (3 soalan)

Dokumen sokongan yang disertakan : Tiada

JANGAN BUKA KERTAS SOALAN INI SEHINGGA DIARAHKAN

(CLO yang tertera hanya sebagai rujukan)

SULIT

SECTION A : 40 MARKS**BAHAGIAN A : 40 MARKAH****INSTRUCTION :**

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

ARAHAN :

*Bahagian ini mengandungi **SEPULUH (10)** soalan struktur. Jawab **SEMUA** soalan.*

CLO1
C1**QUESTION 1**

Draw and label the structure of DIAC and PUT devices.

SOALAN 1

Lukis dan labelkan struktur binaan bagi peranti DIAC dan PUT.

[4 marks]
[4 markah]

CLO1
C2**QUESTION 2**

Differentiate between SCR and TRIAC in terms of terminal and operation.

SOALAN 2

Bezakan antara SCR and TRIAC dari segi terminal dan operasi.

[4 marks]
[4 markah]

CLO1
C2**QUESTION 3**

Define the following terms in the I-V characteristic curve of the SCR :

- i. Forward Breakover Voltage, V_{BO}
- ii. Reversed Breakover Voltage, V_{BR}

SOALAN 3

Terangkan istilah berikut untuk lengkung ciri I-V bagi SCR :

- i. *Voltan Pecah Lampau Hadapan, V_{BO}*
- ii. *Voltan Pecah Lampau Belakang, V_{BR}*

[4 marks]
[4 markah]

QUESTION 4

CLO2
C3 Initiate the expression of the output voltage (V_o) of Single Phase Controlled Half Wave Rectifier with resistive load if the input voltage given is $V = V_m \sin \omega t$ and triggering angle is $\alpha = \omega t$.

SOALAN 4

Terbitkan persamaan bagi voltan keluaran (V_o) bagi Penerus Terkawal Satu Fasa Gelombang Separuh dengan beban rintangan sekiranya diberi voltan masukan adalah $V = V_m \sin \omega t$ dan sudut picuan adalah $\alpha = \omega t$.

[4 marks]

[4 markah]

QUESTION 5

Sketch the waveform of input voltage (V_{in}) and output voltage (V_{out}) for Single Phase Half Wave Controlled Rectifier with resistive load.

SOALAN 5

Lakarkan gelombang voltan masukan (V_{in}) dan voltan keluaran (V_{out}) bagi Penerus Terkawal Gelombang Separuh Satu Fasa dengan beban perintang.

[4 marks]

[4 markah]

QUESTION 6

CLO2
C3 Calculate the triggering angle (α) for $V_s = 215$ V, 50 Hz feeds to a Single Phase Full Wave Controlled Rectifier with 10Ω load and gives the average DC output voltage of 40 V.

SOALAN 6

Kirakan sudut picuan (α) bagi $V_s = 215$ V, 50 Hz diberikan kepada Penerus Terkawal Gelombang Penuh Satu Fasa dengan beban 10Ω dan keluaran voltan AT purata sebanyak 40V.

[4 marks]

[4 markah]

QUESTION 7

CLO2
C3 Illustrate the circuit of the Step-Down DC to DC converter.

SOALAN 7

Bina litar Langkah Turun bagi Penukar AT ke AT.

[4 marks]

[4 markah]

QUESTION 8

CLO2
C3 Illustrate the circuit of the step-up DC to DC converter.

SOALAN 8

Bina litar Langkah Naik bagi Penukar AT ke AT.

[4 marks]

[4 markah]

QUESTION 9

CLO2
C1 Draw the circuit diagram for Single Phase Half Bridge Inverter circuit with resistive load.

SOALAN 9

Lukiskan litar Penyongsang Separuh Gelombang Satu Fasa dengan beban perintang.

[4 marks]

[4 markah]

QUESTION 10

CLO2
C1 Three-phase inverter is normally used for high power application and two types of control signals that can be applied to the transistor are the 120° conduction and 180° conduction. List **TWO (2)** differences between the 120° conduction and 180° conduction.

SOALAN 10

Penyongsang tiga-fasa biasanya digunakan untuk aplikasi kuasa tinggi dan dua jenis isyarat kawalan yang boleh digunakan kepada transistor adalah pengendalian 120° dan pengendalian 180° . Senaraikan **DUA(2)** perbezaan antara pengendalian 120° dan pengendalian 180° .

[4 marks]

[4 markah]

SECTION B : 60 MARKS

BAHAGIAN B : 60 MARKAH

INSTRUCTION :

This section consists of **THREE (3)** essay questions. Answer **ALL** questions.

ARAHAN:

Bahagian ini mengandungi **TIGA (3)** soalan esei. Jawab **SEMUA** soalan.

QUESTION 1

SOALAN 1

CLO1
C1

- (a) Sketch and label the I-V characteristic curve of TRIAC and list its operational step by using the I-V characteristic curve.

Lakar dan label kan lengkung ciri I-V bagi TRIAK dan senaraikan langkah kendalian peranti tersebut berdasarkan lengkung ciri I-V.

[10 marks]

[10 markah]

CLO2
C2

- (b) Based on **Figure B1** name the type of rectifier and explain the circuit operation.

*Berdasarkan **Rajah B1** namakan penerus tersebut dan terangkan operasi litar.*

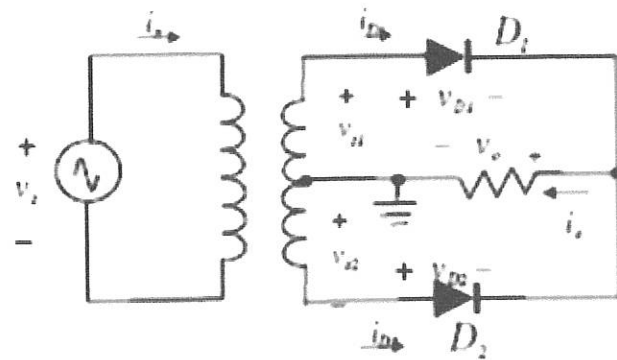


Figure B1 / Rajah B1

[10 marks]

[10 markah]

QUESTION 2

SOALAN 2

CLO2
C3

The DC to DC Converter has input voltage, $V_{in} = 5 \text{ V}$. The required output voltage is $V_o = 15 \text{ V}$ and the average load current is $I_o = 0.5 \text{ A}$. If the switching frequency, $f = 25 \text{ kHz}$, $L = 150 \text{ uH}$ and $C = 220 \text{ uF}$. Determine:

Penukar AT ke AT mempunyai voltan masukan, $V_{in} = 5 \text{ V}$. Voltan keluaran yang dikehendaki $V_o = 15 \text{ V}$ dan purata arus beban adalah $I_o = 0.5 \text{ A}$. Jika frekuensi pensuisan, $f = 25 \text{ kHz}$, $L=150 \text{ uH}$ and $C = 220 \text{ uF}$. Tentukan:

- i. The duty cycle, D
Kitar tugas, D
- ii. The ripple current of inductor, ΔI
Arus riak pearuh, ΔI
- iii. The peak current of inductor, I_2
Arus puncak pearuh, I_2
- iv. The ripple voltage of filter capacitor, ΔV
Voltan riak kapasitor penapis, ΔV

[20 marks]

[20 markah]

QUESTION 3

SOALAN 3

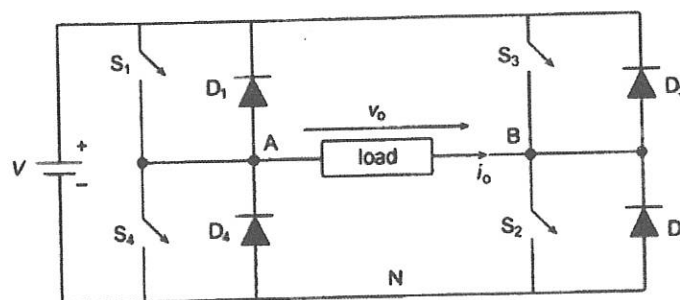
CLO2
C3

Based on the principle operation of Inverter, answer all the questions below.

Berdasarkan prinsip operasi bagi Penyongsang, jawab semua soalan dibawah.

- i. State the main function of inverter.
Nyatakan fungsi utama bagi penyongsang.
- ii. State **TWO (2)** basic switching scheme in voltage source inverter (VSI).
*Berikan **DUA (2)** asas skim pensuisan bagi sumber voltan penyongsang (VSI).*

- iii. Name the circuit of **Figure B3**.
*Namakan litar pada **Figure B3**.*
- iv. Draw the output voltage (V_o) and output current (I_o) waveform if the load used is resistor in **Figure B3**.
*Lukiskan gelombang bagi voltan keluaran (V_o) dan arus keluaran (I_o) sekiranya beban yang digunakan adalah resistor pada **Rajah B3**.*
- v. Based on **Figure B3**, initiate that the output voltage RMS is $V_{O(RMS)} = V$.
*Berdasarkan **Rajah B3**, tunjukkan bahawa voltan keluaran PPGD adalah $V_{O(PPGD)} = V$.*
- vi. Explain the circuit operation of **Figure B3** during the following condition :
*Terangkan operasi litar bagi **Rajah B3** bagi keadaan berikut :*
- During ($0 < \omega t < T/2$)
Semasa ($0 < \omega t < T/2$)
 - During ($T/2 < \omega t < T$)
Semasa ($T/2 < \omega t < T$)

Figure B3 / *Rajah B3*

[20 marks]

[20 markah]

SOALAN TAMAT