

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 berstruktur. Jawab **SEMUA** soalan.*

CLO1
C1

QUESTION 1

List **FOUR (4)** semiconductor devices used in power electronics.

SOALAN 1

*Senaraikan **EMPAT (4)** peranti separuh pengalir yang digunakan di dalam elektronik kuasa.*

[4 marks]

[4 markah]

CLO1
C2

QUESTION 2

Give **TWO (2)** differences between SCR and TRIAC.

SOALAN 2

*Berikan **DUA (2)** perbezaan antara SCR dan TRIAC.*

[4 marks]

[4 markah]

SULIT

POLITEKNIK
 Jabatan Pengajian Politeknik

BAHAGIAN PEPERIKSAAN DAN PENILAIAN
 JABATAN PENGAJIAN POLITEKNIK
 KEMENTERIAN PENDIDIKAN MALAYSIA

JABATAN KEJURUTERAAN ELEKTRIK

PEPERIKSAAN AKHIR

SESI JUN 2013

ET502: POWER ELECTRONICS

TARIKH : 21 OKTOBER 2013

TEMPOH : 2 JAM (2.30 PM - 4.30 PM)

Kertas ini mengandungi **TIGA BELAS (13)** 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

CLO2
C2

QUESTION 5

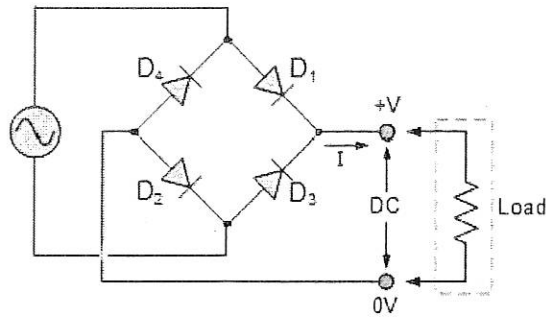


Figure A2 / Rajah A2

Referring to Figure A2, explain the operation of the circuit.

SOALAN 5

Merujuk kepada Rajah A2, terangkan operasi litar tersebut.

[4 marks]

[4 markah]

CLO2
C3

QUESTION 6

A single phase full-wave controlled rectifier used to control the resistive and inductive load. With $\beta = 45^\circ$, sketch the output waveform for:

- i. $\alpha = 45^\circ$
- ii. $\alpha = 60^\circ$

SOALAN 6

Penerus Terkawal Gelombang Penuh Satu Fasa digunakan untuk mengawal beban rintangan dan aruhan. Dengan $\beta = 45^\circ$, lakarkan gelombang keluaran bagi:

- i. $\alpha = 45^\circ$
- ii. $\alpha = 60^\circ$

[4 marks]

[4 markah]

CLO1
C2

QUESTION 3

Explain the following terms;

- i. Latching Current
- ii. Holding Current

SOALAN 3

Terangkan istilah berikut;

- i. Latching Current
- ii. Holding Current

[4 marks]

[4 markah]

CLO2
C3

QUESTION 4

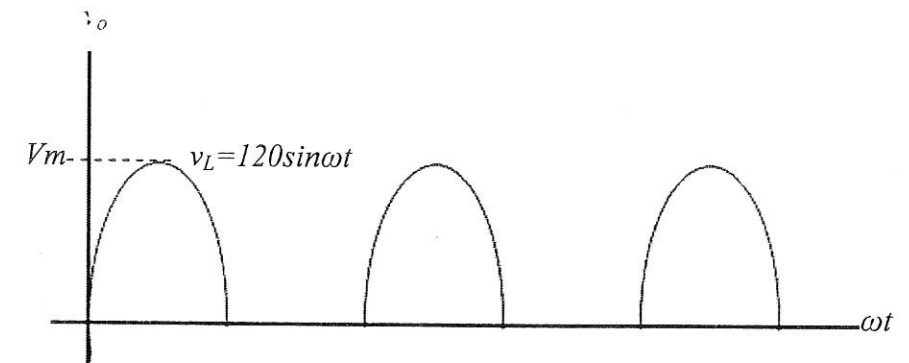


Figure A1/Rajah A1

Referring to Figure A1, calculate output voltage, V_{rms} and output current I_{rms} . Given, resistive load is 25Ω .

SOALAN 4

Merujuk Rajah A1, kirakan voltan keluaran V_{pmkd} dan arus keluaran I_{pmkd} . Diberi, beban resistif adalah 25Ω .

[4 marks]

[4 markah]

SOALAN 8

Buktikan bahawa keluaran purata bagi pemenggal injak turun adalah:

$$V_{o(ave)} = V_s K$$

dimana; $V_s =$ Voltan masukan

$K =$ Kitar kerja

[4 marks]

[4 markah]

CLO2

QUESTION 9

C1

List **FOUR (4)** applications of DC to AC converter in industry.

[4 marks]

[4 markah]

SOALAN 9

Senaraikan **EMPAT (4)** aplikasi penukar AT kepada AU di industri.

[4 marks]

[4 markah]

CLO2

QUESTION 10

C3

Three-phase inverter normally used for high-power applications and two types of control signals that can be applied to the transistors are 180° conduction and 120° conduction.

Determine which of the control signal is better and why?

SOALAN 10

Penyongsang tiga-fasa biasanya digunakan untuk aplikasi kuasa tinggi dan dua jenis isyarat kawalan yang boleh digunakan kepada transistor adalah pengendalian 180° dan pengendalian 120° . Tentukan isyarat kawalan yang manakah lebih baik dan mengapa?

[4 marks]

[4 markah]

CLO2

C3

QUESTION 7

A boost chopper is operate at frequency $f = 5\text{kHz}$. If the conduction time three quarter from the total time, calculate;

- Time ON
- Time OFF

SOALAN 7

Sebuah pemenggal galak beroperasi pada frekuensi $f = 5\text{kHz}$. Jika waktu operasi adalah tiga suku dari waktu keseluruhan, kirakan;

- Masa BUKA
- Masa TUTUP

[4 marks]

[4 markah]

CLO2

C2

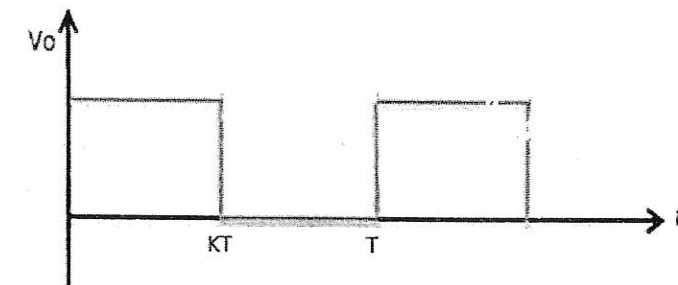
QUESTION 8

Figure A3: Voltage output waveform for step down chopper/
Rajah A3: Gelombang voltan keluaran pemenggal injak turun

Proved the average output voltage of step down chopper is:

$$V_{o(ave)} = V_s K$$

Where; $V_s =$ Voltage supply

$K =$ Duty cycle

- ii. Sketch and label the symbol of the device
Lukis dan labelkan simbol peranti berkenaan.

[2 marks]

[2 markah]

- iii. State the missing parameter A,B,C,D,E,F
Nyatakan parameter A,B,C,D,E,F

[3 marks]

[3 markah]

- iv. State **TWO (2)** method of turning ON and **TWO (2)** method of turning OFF the device.
Nyatakan DUA (2) cara menghidupkan dan DUA (2) cara mematikan peranti berkenaan.

[4 marks]

[4 markah]

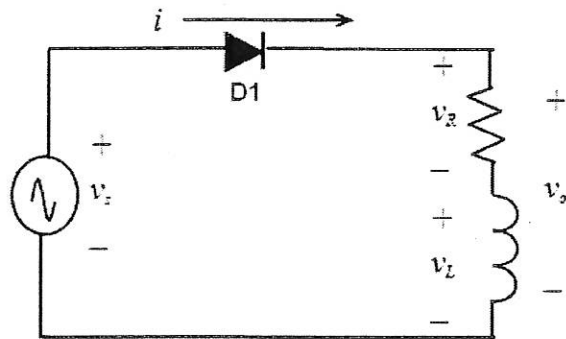


Figure B2: Single Phase Uncontrolled Half Wave Rectifier with Inductive Load/

Rajah B2: Penerus Separuh Gelombang Tidak Terkawal Satu Fasa dengan Beban Peraruh

- (b) Figure B2 shows the schematic circuit of Single Phase Uncontrolled Half Wave Rectifier with inductive load. Based on the figure B2 answer the following;
Rajah B2 menunjukkan litar skematik bagi Penerus Separuh Gelombang Tidak Terkawal Satu Fasa dengan beban peraruh. Berdasarkan rajah B2 diatas, jawab soalan berikut;

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

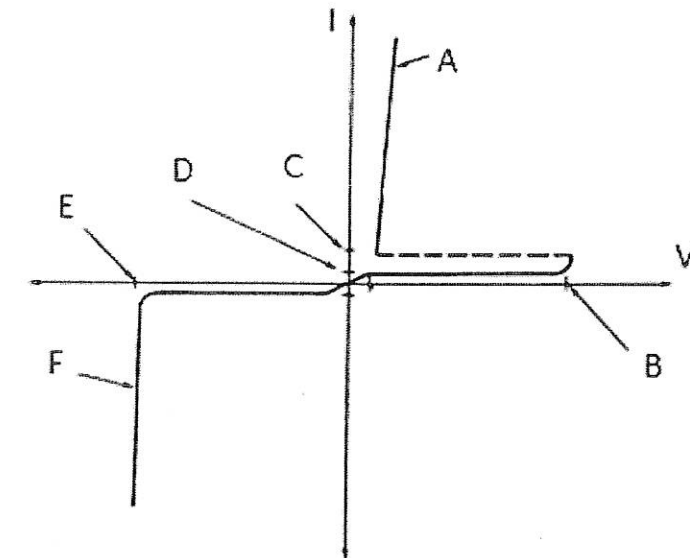


Figure B1: I-V Characteristic/

Rajah B1: Lengkuk Ciri I-V

CLO1
C2

- (a) Figure B1 shows the characteristic of semiconductor device used in rectifier. Based on the figure above answer the following;
Rajah B1 menunjukkan lengkuk ciri bagi peranti separuh pengalir yang digunakan di dalam penerus. Berdasarkan gambarajah diatas, jawab soalan berikut;

- i. Named the device.
Namakan peranti berkenaan.

[1 mark]

[1 markah]

QUESTION 2
SOALAN 2

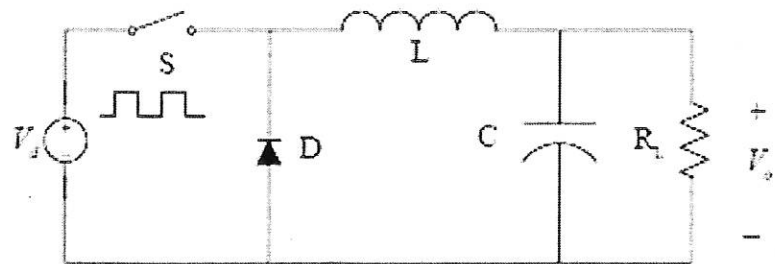


Figure B3: Schematic Circuit For Buck Chopper/

Rajah B3: Litar Skematik Pemenggal Buck

- (a) Figure B3 shows the schematic circuit for buck chopper. Based on the figure above answer the following;

Rajah B3 menunjukkan litar skematik pemenggal buck. Berdasarkan gambarajah diatas, jawab soalan berikut;

CLO2
C1

- i. State the circuit function
Nyatakan fungsi litar berkenaan

[1 mark]

[1 markah]

CLO2
C2

- ii. Briefly explain the circuit operation
Terangkan secara ringkas operasi litar berkenaan.

[6 marks]

[6 markah]

CLO2
C1

- iii. Sketch and label the inductor current for the above circuit.
Lukis dan labelkan arus paruh bagi litar berkenaan.

[3 marks]

[3 markah]

CLO2
C3

- i. Given $V_L=120\sin\omega t$ and $\beta=30^\circ$, find the value of average output voltage and rms output voltage.

Diberi $V_L=120\sin\omega t$ dan $\beta=30^\circ$, cari nilai bagi voltan keluaran purata dan voltan pmkd.

[6 marks]

[6 markah]

- ii. Sketch the input and output voltage waveform of Figure B2.

Lakarkan gelombang masukan dan keluaran bagi Rajah B2.

[4 marks]

[4 markah]

QUESTION 3
SOALAN 3

CLO2
C1

a) State the main function of inverter.
Nyatakan fungsi utama bagi penyongsang.

[2 marks]
[2 markah]

CLO2
C1

b) Gives **TWO (2)** input source of inverter.
Berikan DUA (2) sumber masukan bagi inverter.

[2 marks]
[2 markah]

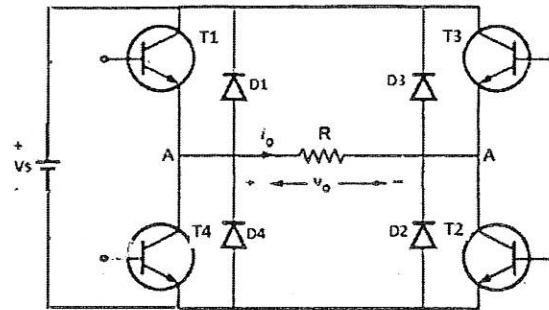


Figure B5
Rajah B5

CLO2
C2

c) Based on the Figure B5, answer the following questions;
Berdasarkan Rajah B5, jawab soalan berikut;

i. Name the circuit.
Namakan litar tersebut.

[1 mark]
[1 markah]

ii. Explain the circuit operation.
Terangkan operasi litar.

[6 marks]
[6 markah]

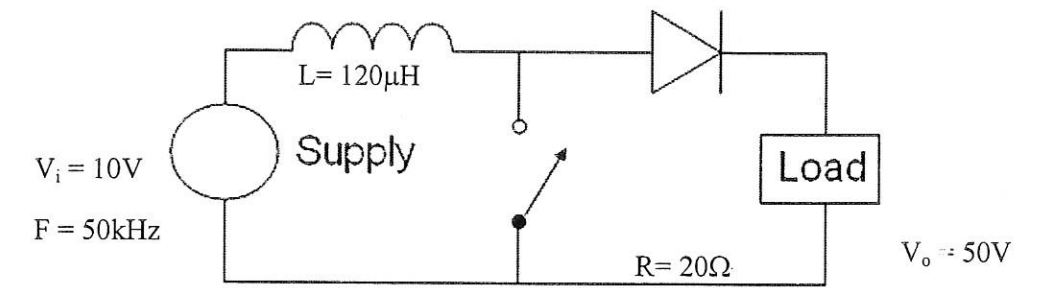


Figure B4: Schematic Circuit for Boost Chopper
Rajah B4: Litar Skematik Pemenggal Boost

CLO2
C3

(b) Figure B4 shows the schematic circuit for Boost chopper. Calculate:
Rajah B4 menunjukkan litar skematik pemenggal boost. Kirakan;

i. Duty cycle
Kitar kerja

[2 marks]
[2 markah]

ii. T_{ON} and T_{OFF}
 T_{ON} dan T_{OFF}

[4 marks]
[4 markah]

iii. Minimum and maximum current.
Arus minimum dan maksimum

[4 marks]
[4 markah]

- iii. Draw output waveform of voltage and current.

Lukis gelombang keluaran voltan dan arus.

[4 marks]

[4 markah]

- iv. Prove $V_o(\text{rms})=V_s$.

Buktikan $V_o(\text{rms})=V_s$.

[5 marks]

[5 markah]

SOALAN TAMAT