SULIT

KEMENTERIAN PENDIDIKAN TINGGI
JABATAN PENDIDIKAN POLITEKNIK DAN KOLEJ KOMUNITI

BAHAGIAN PEPERIKSAAN DAN PENILAIAN
JABATAN PENDIDIKAN POLITEKNIK DAN KOLEJ KOMUNITI
KEMENTERIAN PENDIDIKAN TINGGI

JABATAN KEJURUTERAAN ELEKTRIK

PEPERIKSAAN AKHIR

SESI I: 2025/2026

DET10103: ELECTRICAL CIRCUITS 1

TARIKH : 30 NOVEMBER 2025
MASA : 8.30 PAGI – 10.30 PAGI (2 JAM)

Kertas ini mengandungi **LAPAN (8)** halaman bercetak.
Bahagian A: Struktur (4 soalan)
Bahagian B: Esei (1 soalan)
Dokumen sokongan yang disertakan : Formula

JANGAN BUKA KERTAS SOALAN INI SEHINGGA DIARAHKAN

(CLO yang tertera hanya sebagai rujukan)

SECTION A: 80 MARKS

BAHAGIAN A: 80 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 (a) Define Ohm's Law with a suitable circuit diagram

Takrifkan Hukum Ohm dengan bantuan rajah litar yang sesuai

[4 marks]

[*4 markah*]

CLO1 (b) Based on Figure A1(b) below, simplify the circuit to obtain the equivalent resistance, R_T

Berdasarkan Rajah A1(b) di bawah, permudahkan litar tersebut untuk mendapatkan rintangan setara, R_T.

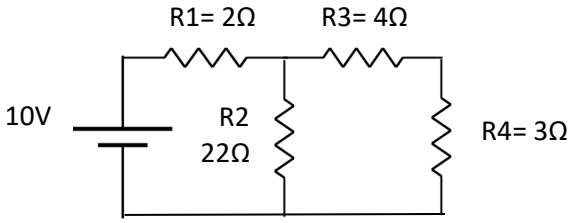

Figure A1(b)/ *Rajah A1(b)*

[6 marks]

[*6 markah*]

CLO1

(c) By referring to the circuit in Figure A1(c), calculate the energy supplied by the battery after 20s and the energy absorbed by the 22Ω resistor after 2 hours.

Dengan merujuk kepada litar dalam Rajah A1(c), kira tenaga yang dibekalkan oleh bateri selepas 20s dan tenaga yang diserap oleh perintang 22Ω selepas 2 jam.

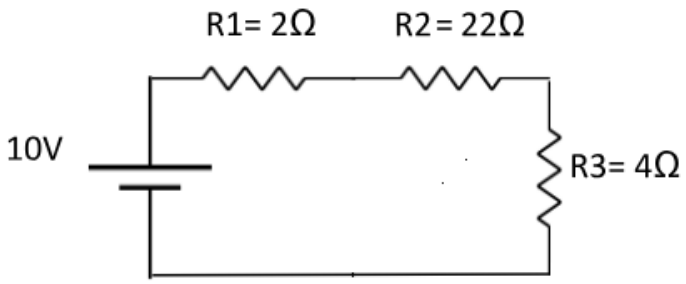

Figure A1(c)/*Rajah A1(c)*

[10 marks]

[*10 markah*]

QUESTION 2

SOALAN 2

CLO1

(a) Define Norton's Theorem with the aid of suitable circuit diagram.

Takrifkan Teorem Norton dengan bantuan gambar rajah litar yang sesuai.

[4 marks]

[*4 markah*]

CLO1

(b) Referring to Figure A2(b), explain the factors affecting capacitance.

Merujuk kepada Rajah A2(b), terangkan faktor yang mempengaruhi kemuatan.

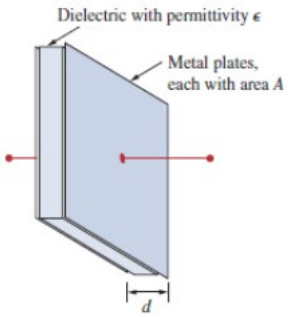

Figure A2(b)/ Rajah A2(b)

[6 marks]

[*6 markah*]

CLO1

(c) A capacitor with a capacitance of **X** is connected in series with a 1000Ω resistor and supplied by a 9V DC voltage source. Referring to Figure A2(c), calculate the capacitance value of **X**, initial current, initial potential difference across capacitor, voltage across the capacitor after 12ms and energy stored in the capacitor.

Sebuah kapasitor dengan kemuatan X disambung sesiri dengan perintang 1000 Ω *dan dibekalkan dengan bekalan voltan AT 9V. Berdasarkan Rajah A2(c), kirakan nilai kemuatan X, arus mula, voltan merintangi kapasitor selepas 12ms dan tenaga yang disimpan dalam pemuat.*

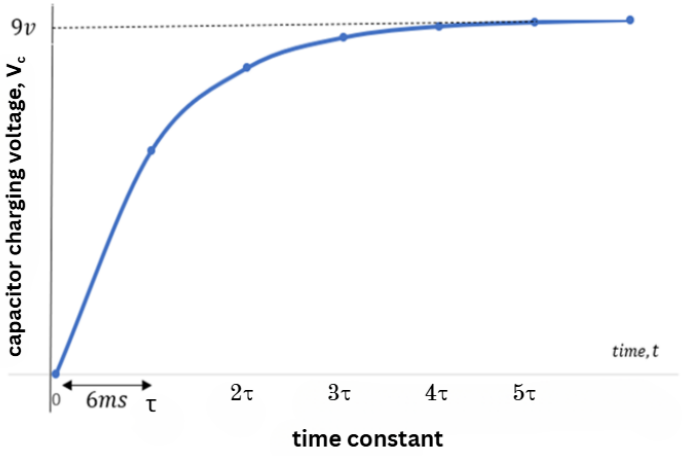

Figure A2(c)/ *Rajah A2(c)*

[10 marks]

[*10 markah*]

QUESTION 3

SOALAN 3

CLO1 (a) State **TWO (2)** Faraday's Law of electromagnetic induction.
*Nyatakan **DUA (2)** Hukum Faraday bagi aruhan elektromagnet.*

[4 marks]

[*4 markah*]

CLO1 (b) By referring to Figure A3(b), simplify the circuit to obtain the equivalent inductance (Lt) at terminal A-B.
Dengan merujuk kepada Rajah A3(b), permudahkan litar untuk mendapatkan nilai kearuhan setara (Lt) pada terminal A-B.

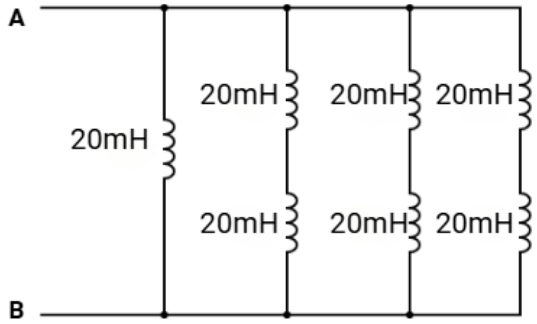

Figure A3(b)/ *Rajah A3(b)*

[6 marks]

[*6 markah*]

CLO1

(c) Figure A3(c) shows a series RL circuit consisting of a 10Ω resistor and a 200mH inductor. The circuit is connected to a 20V DC voltage source and the switch is initially open. When the switch is pressed (closed at t=0s), calculate the time constant of the circuit, the voltage across the inductor at the instant the switch is closed, the maximum current flowing through the circuit and the inductor current at t=10ms.

Rajah A3(c) menunjukkan satu litar siri RL yang terdiri daripada perintang 10Ω dan peraruh 200mH. Litar ini disambungkan kepada 20V bekalan voltan AT dan suis pada mulanya terbuka. Apabila suis ditekan (ditutup pada t=0s); hitungkan pemalar masa litar tersebut, voltan merintangi peraruh pada saat suis ditutup, nilai arus maksimum yang mengalir dalam litar dan nilai arus dalam peraruh pada t=10ms.

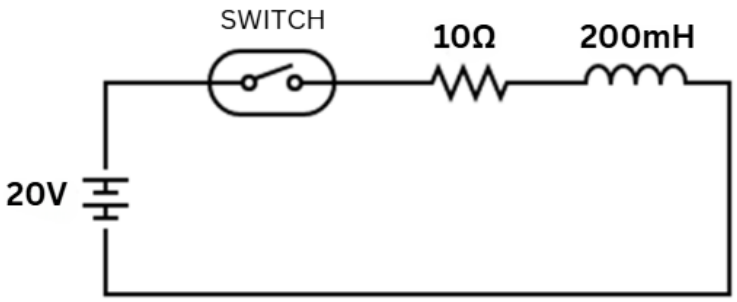

Figure A3(c) / *Rajah A3(c)*

[10 marks]

[*10 markah*]

QUESTION 4

SOALAN 4

CLO1 (a) Describe **FOUR (4)** characteristics of a magnetic field.
*Huraikan **EMPAT (4)** ciri-ciri medan magnet.*

[4 marks]
[*4 markah*]

CLO1 (b) The electric circuit and the magnetic circuit are closed paths for electric current and magnetic flux. Compare the difference between these two circuits.
Litar elektrik dan litar magnet ialah laluan tertutup untuk arus elektrik dan fluks magnet. Bandingkan perbezaan antara kedua-dua litar ini.

[6 marks]
[6 *markah*]

CLO1 (c) Referring to Figure A4(c), with the DELTA-STAR transformation, calculate the total resistance (R_T) and total current (I_T).
Merujuk Rajah A4(c), dengan penukaran DELTA-BINTANG, kirakan jumlah rintangan (R_T) *dan jumlah arus* (I_T).

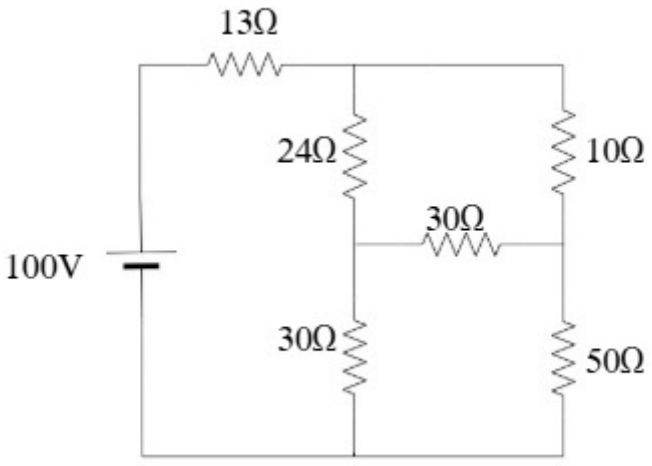

Figure A4(c) / *Rajah A4(c)*

[10 marks]
[*10 markah*]

SECTION B: 20 MARKS
BAHAGIAN B: 20 MARKAH

INSTRUCTION:
This section consists of **ONE (1)** essay question. Answer the question.

ARAHAN:
*Bahagian ini mengandungi **SATU (1)** soalan esei. Jawab soalan tersebut.*

QUESTION 1
SOALAN 1

CLO1 There are many analysis methods to calculate unknown current or voltage in a DC circuit. Kirchhoff's Laws are the fundamental rule for analyzing electrical circuits, which are Kirchoff's Current Law (KCL) and Kirchhoff's Voltage Law (KVL). KCL states that the algebraic sum of all currents entering and exiting a junction (or node) in an electrical circuit is zero. Meanwhile, KVL states that the algebraic sum of all voltages in any closed loop of an electrical circuit is zero. By applying Kirchhoff's Law, calculate i1, i2 and i3 in the circuit shown in Figure B1.

Terdapat banyak kaedah analisis untuk mengira arus atau voltan yang tidak diketahui dalam litar AT. Hukum Kirchhoff ialah peraturan asas yang digunakan untuk menganalisis litar elektrik. Hukum ini merangkumi Hukum Arus Kirchoff (KCL) dan Hukum Voltan Kirchhoff (KVL). KCL menyatakan bahawa jumlah algebra bagi semua arus yang masuk dan keluar pada simpang (atau nod) dalam litar elektrik ialah sifar. Sementara itu, KVL pula menyatakan bahawa jumlah algebra bagi semua voltan dalam mana-mana gelung tertutup litar elektrik ialah sifar. Dengan menggunakan Hukum Kirchhoff, kirakan nilai arus i1, i2 dan i3 bagi litar yang ditunjukkan dalam Rajah B1.

[20 marks]
[*20 markah*]

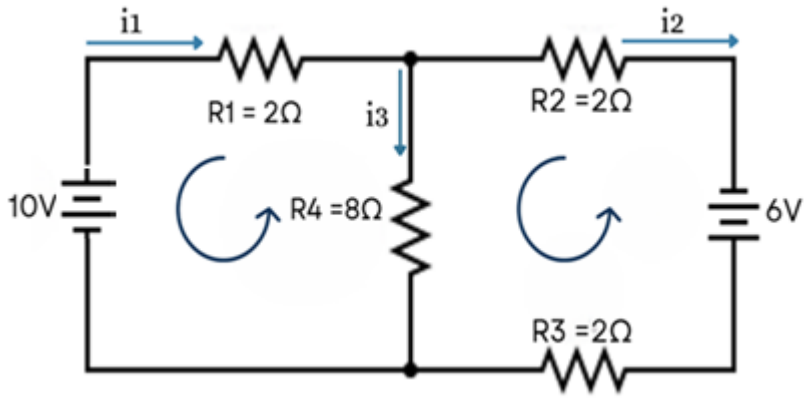

Figure B1 / *Rajah B1*

SOALAN TAMAT

APPENDIX – Related Formulas

$$Q = It \qquad R = \frac{\rho l}{A} \qquad V = IR$$

$$P = IV \qquad R_T = R_1 + R_2 + \cdots + R_n \qquad R_T = \frac{1}{\frac{1}{R_1} + \frac{1}{R_2} + \cdots + \frac{1}{R_n}}$$

$$W = Pt \qquad C = \frac{Q}{V} \qquad E = \frac{V}{d}$$

$$I_L = \frac{V_{TH}}{R_L + R_{TH}} \qquad I_L = \frac{R_N}{R_N + R_L} \times I_N \qquad D = \frac{Q}{A}$$

$$C = \frac{\varepsilon_r \varepsilon_0 A}{d} \qquad \varepsilon = \varepsilon_0 \varepsilon_r = \frac{D}{E} \qquad \tau = RC$$

$$\varepsilon_0 = 8.854 \times 10^{-12} \qquad \tau = \frac{L}{R}$$

$$\mu = \mu_0 \mu_r \qquad E_C = \frac{1}{2} CV^2 \qquad E_L = \frac{1}{2} LI^2$$

$$\mu_0 = 4\pi \times 10^{-7}$$

$$v_C(t) = V_{max}(1 - e^{-t/\tau}) \qquad i_C(t) = I_{max}\,(e^{-t/\tau}) \qquad i_L(t) = I_{max}(1 - e^{-t/\tau})$$

$$v_C(t) = V_{max}(e^{-t/\tau}) \qquad i_C(t) = -I_{max}\,(e^{-t/\tau}) \qquad i_L(t) = I_{max}(e^{-t/\tau})$$

$$E = -L\frac{dI}{dt} \qquad E = -N\frac{d\phi}{dt} \qquad L = \frac{N\phi}{I}$$

$$H = \frac{F_m}{l} \qquad L = \frac{N^2 \mu_r \mu_0 A}{l} \qquad F_m = IN$$

$$\mu = \frac{B}{H} \qquad B = \frac{\phi}{A} \qquad S = \frac{F_m}{\phi}$$

$$V_{R1} = \frac{R_1}{R_1 + R_2 + \cdots + R_n} \times E \qquad S = \frac{l}{\mu_0 \mu_r A} \qquad I_{R1} = \frac{R_2}{R_1 + R_2} \times I$$

$$R_T = \frac{R_1 \times R_2}{R_1 + R_2} \qquad I_{R1} = \frac{\frac{1}{R_1}}{\frac{1}{R_1} + \frac{1}{R_2} + \cdots + \frac{1}{R_n}} \times I$$