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

DET20123: ELECTRICAL CIRCUIT 2

TARIKH : 29 NOVEMBER 2025
MASA : 8.30 PAGI – 10.30 PAGI (2 JAM)

Kertas ini mengandungi **ENAM (6)** 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)** subjective questions. Answer **ALL** questions.

ARAHAN:
*Bahagian ini mengandungi **EMPAT (4)** soalan subjektif. Jawab **SEMUA** soalan.*

QUESTION 1

SOALAN 1

CLO1 (a) Describe **TWO (2)** reasons why Alternating Current (AC) is used in preference compared to Direct Current (DC).
*Huraikan **DUA (2)** sebab mengapa Arus Ulang Alik (AU) digunakan sebagai keutamaan berbanding Arus Terus (AT).*

[4 marks]
[*4 markah*]

CLO1 (b) Explain briefly Faraday's and Lenz's Law involved in generating alternating current.

Terangkan secara ringkas Hukum Faraday's dan Hukum Lenz's dalam menjana arus ulang alik.

[6 marks]
[*6 markah*]

CLO1 (c) An alternating current voltage is given by V = 120 sin (100πt - 0.65) V. Calculate the peak-to-peak voltage, periodic time, frequency, and the value of voltage when t = 0.5 ms.

Diberi voltan arus ulang alik ialah V = 120 sin (100πt - 0.65). Kirakan voltan puncak ke puncak, masa yang berkala, frekuensi dan *nilai voltan ketika t = 0.5 ms.*

[10 marks]
[*10 markah*]

QUESTION 2

SOALAN 2

CLO1 (a) Given that the voltage sinusoidal equation is V(t) = Vp sin (ωt). With the aid of diagram, express the current sinusoidal equation for a purely inductive AC circuit and a purely capacitive AC circuit.

Diberi persamaan sinusoidal bagi voltan ialah V(t) = Vp sin (ωt). Dengan bantuan gambarajah, terbitkan persamaan sinusoidal bagi arus untuk litar AU induktif tulen dan litar AU kapasitif tulen.

[5 marks]

[*5 markah*]

CLO1 (b) Explain the reactive power.

Terangkan kuasa reaktif.

[5 marks]

[*5 markah*]

CLO1 (c) A coil of inductance 100mH is connected in series with a capacitance of 0.12μF and a resistance of 25Ω across a 200V, variable frequency supply. Calculate the resonant frequency, Q factor, bandwidth of the circuit, current flow, and voltage drops at inductance during the resonance.

Satu gelung aruhan 100mH disambungkan secara siri dengan kemuatan 0.12μF dan rintangan 25Ω merentasi bekalan 200V, frekuensi boleh ubah. Kirakan frekuensi resonans, faktor Q, lebar jalur litar, arus mengalir dan kejatuhan voltan pada induktif ketika resonans.

[10 marks]

[*10 markah*]

QUESTION 3

SOALAN 3

CLO1 (a) State **FOUR (4)** characteristics of a non-ideal transformer.

*Nyatakan **EMPAT (4)** ciri bagi pengubah tidak ideal.*

[4 marks]

[*4 markah*]

CLO1 (b) Explain **THREE (3)** importance of the core material in a transformer.

*Terangkan **TIGA (3)** kepentingan bahan teras dalam pengubah.*

[6 marks]

[*6 markah*]

CLO1 (c) Referring to Figure A3(c), calculate the value of primary current, secondary voltage, and resistive load.

Merujuk kepada Rajah A3(c), kirakan nilai arus primer, voltan sekunder dan beban rintangan.

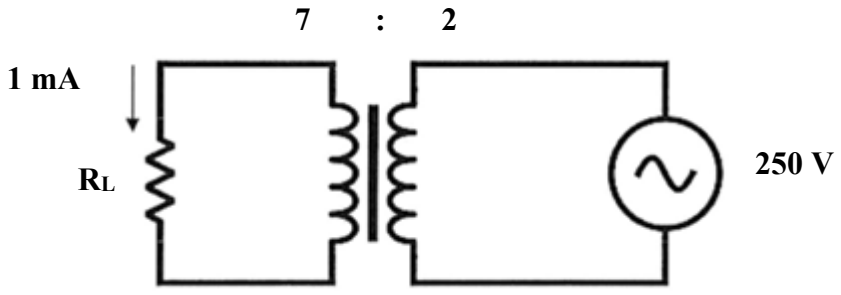


Figure A3(c) / *Rajah A3(c)*

[10 marks]

[*10 markah*]

QUESTION 4

SOALAN 4

CLO1 (a) Explain the resonance phenomenon and its functions.

Terangkan fenomena resonans dan fungsinya.

[5 marks]

[*5 markah*]

CLO1 (b) With the aid of a diagram, explain the basic principles of a three-phase system.

Dengan bantuan gambarajah, terangkan prinsip asas sistem tiga fasa.

[5 marks]

[*5 markah*]

CLO1 (c) Each phase in Star-connection consist of 30Ω resistor and 50mH inductor connected in series. These loads are supplied with line voltage 440V and frequency 50Hz. Calculate the phase current and line current.

Setiap fasa di dalam sambungan Bintang terdiri daripada perintang 30Ω dan peraruh 50mH disambungkan secara bersiri. Beban ini dibekalkan dengan voltan talian 440V dan frekuensi 50Hz. Kirakan arus fasa dan arus talian.

[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.*

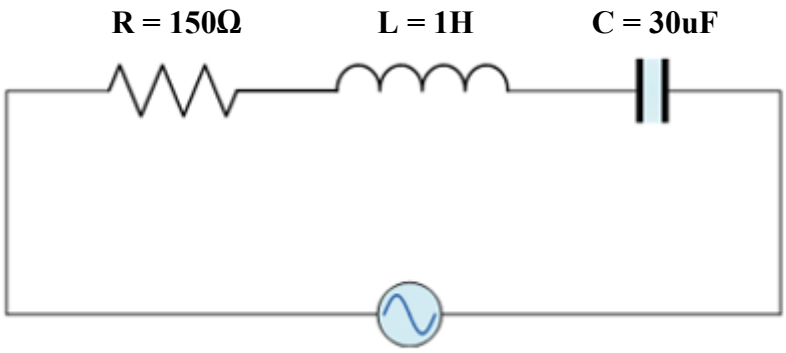
QUESTION 1

SOALAN 1

CLO1

Figure B1 shows the RLC series circuit with 150 Ω resistor, L = 1H inductor and C = 30uF capacitor. By using suitable power triangle diagram, calculate the value of active power, reactive power and apparent power.

Rajah B1 menunjukkan litar siri RLC dengan perintang 150 Ω, peraruh L = 1H dan pemuat, C = 30uF . *Dengan menggunakan rajah segitiga kuasa yang sesuai, kirakan nilai kuasa aktif, kuasa reaktif dan kuasa ketara.*



Vs = 240 V

f **= 50Hz**

Figure B1 / *Rajah B1*

[20 marks]
[*20 markah*]

SOALAN TAMAT

SENARAI FORMULA

$\boldsymbol{V_P = \sqrt{2} \times V_{rms}}$	$\boldsymbol{v(t) = V_P sin(\omega t \pm \theta)}$	$\boldsymbol{X_L = 2\pi fL}$
$\boldsymbol{I_P = \sqrt{2} \times I_{rms}}$	$i(t) = I_P sin(\omega t \pm \theta)$	$X_C = \dfrac{1}{2\pi fC}$
$\boldsymbol{V_{PP} = 2V_P}$	$Z_T = \sqrt{R^2 + X_{eq}^2}$ $if\ X_L > X_C;\ \ X_{eq} = X_L - X_C$ $if\ X_C > X_L;\ \ X_{eq} = X_C - X_L$	
$\boldsymbol{I_{PP} = 2I_P}$	$S = IV$ $S = I^2 Z$	$I_T = \dfrac{V_S}{Z_T}$
$\boldsymbol{V_{rms} = \dfrac{V_P}{\sqrt{2}}}$	$P = IV cos\,\theta$ $P = I^2 R$	$\theta = \cos^{-1} PF$
$\boldsymbol{I_{rms} = \dfrac{I_P}{\sqrt{2}}}$	$Q = IV sin\,\theta$ $Q = I^2 \lvert X_C - X_L \rvert$	$\theta = \tan^{-1}\left(\dfrac{X_C - X_L}{R}\right)$ $\theta = \tan^{-1}\left(\dfrac{V_C - V_L}{V_S}\right)$
$\boldsymbol{V_{ave} = \dfrac{2V_P}{\pi}}$	$I_T = \sqrt{I_R^2 + (I_C - I_L)^2}$	$\cos\theta = \dfrac{R}{Z}$
$\boldsymbol{I_{ave} = \dfrac{2I_P}{\pi}}$	$Z_T = \dfrac{V_S}{I_T}$	$V_R = IR$
$\boldsymbol{T = \dfrac{1}{f}}$ $\boldsymbol{T = \dfrac{2\pi}{\omega}}$	$\theta = \tan^{-1}\left(\dfrac{I_C - I_L}{I_R}\right)$	$V_L = IX_L$
$\boldsymbol{f = \dfrac{1}{T}}$ $\boldsymbol{f = \dfrac{\omega}{2\pi}}$	$f_r = \dfrac{1}{2\pi}\sqrt{\dfrac{1}{LC} - \dfrac{R^2}{L^2}}$	$V_C = IX_C$
$\boldsymbol{Z_T = \sqrt{R^2 + X_{eq}^2} = \sqrt{R^2 + 0} = R}$		$BW = f_H - f_L = \dfrac{f_r}{Q}$
$\boldsymbol{I_T = \dfrac{V_S}{R}}$	$f_L = f_r - \dfrac{BW}{2}$	$f_L = f_r + \dfrac{BW}{2}$

$\boldsymbol{\theta = \cos^{-1} PF = \cos^{-1} 1 = 0°}$		$f_L = f_r + \frac{BW}{2}$
$\boldsymbol{\theta = \tan^{-1}\left(\frac{X_C - X_L}{R}\right) = \tan^{-1}\left(\frac{0}{R}\right) = 0°}$ $\boldsymbol{\theta = \tan^{-1}\left(\frac{V_C - V_L}{V_S}\right) = \tan^{-1}\left(\frac{0}{V_S}\right) = 0°}$		$Q = \frac{X_L}{R} = \frac{f_r}{BW}$
$\boldsymbol{\cos\theta = \frac{R}{Z} = \frac{R}{R} = 1}$		$\eta = \frac{N_1}{N_2} = \frac{V_1}{V_2} = \frac{I_2}{I_1}$
$\boldsymbol{f_r = \frac{1}{2\pi\sqrt{LC}}}$		$V_2 = \frac{N_2}{N_1} \times V_1$ $V_2 = \frac{P_2}{I_2}$
$\boldsymbol{Q = \frac{X_L}{R} = \frac{X_C}{R} = \frac{V_L}{V_S} = \frac{V_C}{V_S} = \frac{1}{R}\sqrt{\frac{L}{C}} = \frac{f_r}{BW}}$		$V_1 = \frac{N_1}{N_2} \times V_2$ $V_1 = \frac{P_1}{I_1}$
$\boldsymbol{I_1 = \frac{N_2}{N_1} \times I_2}$	$I_2 = \frac{V_2}{R_L}$	$S_1 = S_2$ $I_1 V_1 = I_2 V_2$
$\boldsymbol{Z_P = \sqrt{R^2 + X_{eq}^2}}$ $\boldsymbol{if\ X_L > X_C;\ \ X_{eq} = X_L - X_C}$ $\boldsymbol{if\ X_C > X_L;\ \ X_{eq} = X_C - X_L}$ $\boldsymbol{Z_P = \frac{V_P}{I_P}}$		$P_1 = I_1 V_1$ $P_2 = I_2 V_2 \quad or \quad P_2 = I_2^2 R_L$ $P_1 = P_2$
$\boldsymbol{V_L = V_{RY} = V_{YB} = V_{BR}}$ $\boldsymbol{V_L = \sqrt{3}\, V_P}$	$V_L = V_{RY} = V_{YB} = V_{BR}$ $V_L = V_P$	$S = 3\, I_P V_P$ $S = \sqrt{3}\, I_L V_L$
$\boldsymbol{V_P = V_R = V_Y = V_B}$ $\boldsymbol{V_P = \frac{V_L}{\sqrt{3}}}$	$V_P = V_L$	$P = 3\, I_P V_P \cos\theta$ $P = \sqrt{3}\, I_L V_L \cos\theta$
$\boldsymbol{I_P = \frac{V_P}{Z_P}}$ $\boldsymbol{I_P = I_L}$	$I_P = \frac{V_P}{Z_P}$ $I_P = \frac{I_L}{\sqrt{3}}$	
$\boldsymbol{I_L = I_P}$	$I_L = \sqrt{3}\, I_P$	