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 II : 2024/2025

DET20033: ELECTRICAL CIRCUITS

TARIKH : 28 MEI 2025
MASA : 8.30 PAGI – 10.30 PAGI (2 JAM)

Kertas ini mengandungi **LIMA (5)** 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)** structure questions. Answer **ALL** questions.

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

QUESTION 1

SOALAN 1

CLO1 (a) Identify **TWO (2)** differences between an alternating current and direct current.

*Kenalpasti **DUA (2)** perbezaan diantara arus ulang alik dan arus terus.*

[4 marks]
[*4 markah*]

CLO1 (b) Convert from AC voltage equation $V= 20\ sin\ (\omega t + \pi/2) volt$ and $V= 12\ sin\ (\omega t - \pi/2) volt$ to AC voltage waveform.

Tukarkan persamaan voltan AU $V= 20\ sin\ (\omega t + \pi/2) volt$ *dan* $V= 12\ sin\ (\omega t - \pi/2) volt$ *ke gelombang voltan AU.*

[6 marks]
[*6 markah*]

CLO1 (c) An alternating voltage equation is given by $V= 215\ sin\ (100\pi t + 0.25) V$. Calculate the value of amplitude, frequency, phase angle in degree and the voltage when t=5.5ms

Satu persamaan voltan ulang alik diberi oleh $V= 215\ sin\ (100\pi t + 0.25)\ V$. *Kirakan nilai amplitud, frekuensi, sudut fasa dalam darjah dan voltan apabila masa, t=5.5ms*

[10 marks]
[*10 markah*]

QUESTION 2

SOALAN 2

CLO1 (a) With the aid of a waveform diagram, explain the relationship between current and voltage for a purely resistive and a purely inductive in an alternating current (AC) circuit.

Dengan bantuan gambarajah gelombang, jelaskan hubungan antara arus dan voltan untuk rintangan tulen dan induktif tulen dalam litar arus ulang alik (AU).

[5 marks]
[*5 markah*]

CLO1 (b) Explain the alternating current (AC) circuit's power factor.

Terangkan faktor kuasa dalam litar arus ulangalik (AU).

[5 marks]
[*5 markah*]

CLO1 (c) A coil that has a resistance of 10Ω and inductance of 125mH is connected in series with a 60μF capacitor across a 120V, with variable frequency supply. Calculate the frequency resonance, the current flowing at the resonant frequency, voltage across inductor and capacitor at resonance and Quality factor (Q-factor) of the circuit.

Satu gegelung yang mempunyai rintangan 10Ω dan inductor 125mH disambungkan secara bersiri dengan kapasitor 60μF merentasi bekalan voltan 120V dengan frekuensi boleh ubah. Kirakan frekuensi resonans, arus yang mengalir ketika frekuensi resonans, voltan merintangi induktor dan kapasitor pada resonans dan faktor kualiti (Q-factor) pada litar tersebut.

[10 marks]
[10 markah]

QUESTION 3

SOALAN 3

CLO1 (a) List **FOUR (4)** characteristics of an ideal transformer.

*Senaraikan **EMPAT (4)** ciri- ciri bagi pengubah unggul.*

[4 marks]

[*4 markah*]

CLO1 (b) Explain **THREE (3)** parts of a basic transformer.

*Huraikan **TIGA (3)** bahagian asas pengubah.*

[6 marks]

[*6 markah*]

CLO1 (c) Referring to the figure A3 (c), calculate the value of primary voltage (V_P) secondary voltage (Vs), primary current (I_P) and secondary current (I_s)

Merujuk rajah A3(c), kirakan nilai voltan primer (V_P), voltan sekunder (Vs), arus primer (I_P) dan arus sekunder (I_s)

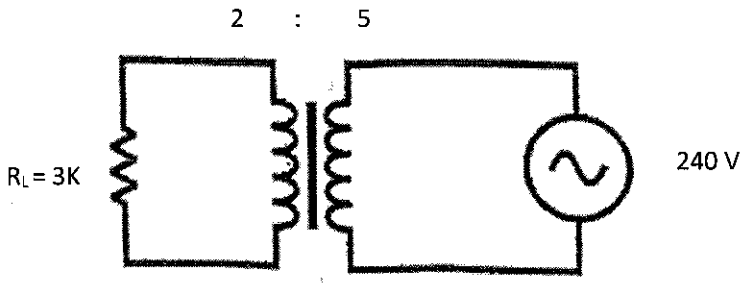

Figure A3(c)/ *Rajah A3(c)*

[10 marks]

[*10 markah*]

QUESTION 4

SOALAN 4

CLO1 (a) With the aid of an appropriate diagram, explain the effects of changing the frequency to RLC series circuit.

Dengan bantuan gambarajah yang sesuai, terangkan kesan perubahan frekuensi terhadap litar siri RLC.

[5 marks]
[*5 markah*]

CLO1 (b) Explain the basic principles of a three-phase system.

Terangkan prinsip asas sistem tiga fasa.

[5 marks]
[*5 markah*]

CLO1 (c) A three-phase load are connected to 415V, 50Hz voltage supply. Each phase consists of 20Ω resistor which connected in series with 3mH inductor in Delta Connection. Calculate the phase and line current.

Satu beban tiga fasa disambungkan dengan 415V, 50Hz bekalan voltan. Setiap fasa mengandungi 20Ω perintang yang disambungkan secara siri dengan 3mH induktor dalam Sambungan Delta. 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 questions. Answer the question.

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

QUESTION 1

CLO1 ***SOALAN 1***

A coil of inductance 191mH and resistance 40Ω is connected in parallel with a 30μF capacitor across a 240V, 50Hz supply. Calculate the current in the coil, current in the capacitor, the supply current, the circuit impedance, power consumed, apparent power and the reactive power.

Satu gegelung yang mempunyai kearuhan 191mH dan rintangan 40Ω disambungkan secara selari dengan kapasitor 30μF merentasi bekalan 240V, 50Hz. Kira arus di dalam gelung, arus di dalam kapasitor, arus bekalan, galangan litar, kuasa yang digunakan, kuasa ketara dan kuasa reaktif

[20 marks]
[*20 markah*]

SOALAN TAMAT

SENARAI FORMULA

$$V_P = \sqrt{2} \times V_{rms}$$

$$I_P = \sqrt{2} \times I_{rms}$$

$$V_{PP} = 2V_P$$

$$I_{PP} = 2I_P$$

$$V_{rms} = \frac{V_P}{\sqrt{2}}$$

$$I_{rms} = \frac{I_P}{\sqrt{2}}$$

$$V_{ave} = \frac{2V_P}{\pi}$$

$$I_{ave} = \frac{2I_P}{\pi}$$

$$T = \frac{1}{f}$$

$$T = \frac{2\pi}{\omega}$$

$$f = \frac{1}{T}$$

$$f = \frac{\omega}{2\pi}$$

$$Z_T = \sqrt{R^2 + X_{eq}^2} = \sqrt{R^2 + 0} = R$$

$$I_T = \frac{V_S}{R}$$

$$\theta = \cos^{-1} PF = \cos^{-1} 1 = 0°$$

$$v(t) = V_P sin(\omega t \pm \theta)$$

$$i(t) = I_P sin(\omega t \pm \theta)$$

$$Z_T = \sqrt{R^2 + X_{eq}^2}$$

$$if\ X_L > X_C;\quad X_{eq} = X_L - X_C$$

$$if\ X_C > X_L;\quad X_{eq} = X_C - X_L$$

$$S = IV$$

$$S = I^2 Z$$

$$P = IV\cos\theta$$

$$P = I^2 R$$

$$Q = IV\sin\theta$$

$$Q = I^2 |X_C - X_L|$$

$$I_T = \sqrt{I_R^2 + (I_C - I_L)^2}$$

$$Z_T = \frac{V_S}{I_T}$$

$$\theta = \tan^{-1}\left(\frac{I_C - I_L}{I_R}\right)$$

$$f_r = \frac{1}{2\pi}\sqrt{\frac{1}{LC} - \frac{R^2}{L^2}}$$

$$f_L = f_r - \frac{BW}{2}$$

$$f_L = f_r + \frac{BW}{2}$$

$$X_L = 2\pi f L$$

$$X_C = \frac{1}{2\pi f C}$$

$$\theta = \cos^{-1} PF$$

$$\theta = \tan^{-1}\left(\frac{X_C - X_L}{R}\right)$$

$$\theta = \tan^{-1}\left(\frac{V_C - V_L}{V_S}\right)$$

$$\cos\theta = \frac{R}{Z}$$

$$V_R = IR$$

$$V_L = IX_L$$

$$V_C = IX_C$$

$$BW = f_H - f_L = \frac{f_r}{Q}$$

$$\theta = \tan^{-1}\left(\frac{X_C - X_L}{R}\right) = \tan^{-1}\left(\frac{0}{R}\right) = 0°$$

$$\theta = \tan^{-1}\left(\frac{V_C - V_L}{V_S}\right) = \tan^{-1}\left(\frac{0}{V_S}\right) = 0°$$

$$Q = \frac{X_L}{R} = \frac{f_r}{BW}$$

$$\cos\theta = \frac{R}{Z} = \frac{R}{R} = 1$$

$$\eta = \frac{N_1}{N_2} = \frac{V_1}{V_2} = \frac{I_2}{I_1}$$

$$f_r = \frac{1}{2\pi\sqrt{LC}}$$

$$V_2 = \frac{N_2}{N_1} \times V_1$$

$$V_2 = \frac{P_2}{I_2}$$

$$Q = \frac{X_L}{R} = \frac{X_C}{R} = \frac{V_L}{V_S} = \frac{V_C}{V_S} = \frac{1}{R}\sqrt{\frac{L}{C}} = \frac{f_r}{BW}$$

$$V_1 = \frac{N_1}{N_2} \times V_2$$

$$V_1 = \frac{P_1}{I_1}$$

$$I_1 = \frac{N_2}{N_1} \times I_2$$

$$I_2 = \frac{V_2}{R_L}$$

$$S_1 = S_2$$

$$I_1 V_1 = I_2 V_2$$

$$Z_P = \sqrt{R^2 + X_{eq}^2}$$

$$if\ X_L > X_C;\quad X_{eq} = X_L - X_C$$

$$if\ X_C > X_L;\quad X_{eq} = X_C - X_L$$

$$Z_P = \frac{V_P}{I_P}$$

$$P_1 = I_1 V_1$$

$$P_2 = I_2 V_2 \quad or \quad P_2 = I_2^2 R_L$$

$$P_1 = P_2$$

$$V_L = V_{RY} = V_{YB} = V_{BR}$$

$$V_L = \sqrt{3}\, V_P$$

$$V_L = V_{RY} = V_{YB} = V_{BR}$$

$$V_L = V_P$$

$$S = 3\, I_P V_P$$

$$S = \sqrt{3}\, I_L V_L$$

$$V_P = V_R = V_Y = V_B$$

$$V_P = \frac{V_L}{\sqrt{3}}$$

$$V_P = V_L$$

$$P = 3\, I_P V_P \cos\theta$$

$$P = \sqrt{3}\, I_L V_L \cos\theta$$

$$I_P = \frac{V_P}{Z_P}$$

$$I_P = I_L$$

$$I_P = \frac{V_P}{Z_P}$$

$$I_P = \frac{I_L}{\sqrt{3}}$$

$$I_L = I_P$$

$$I_L = \sqrt{3}\, I_P$$