

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 MEKANIKAL

PEPERIKSAAN AKHIR

SESI II : 2023/2024

DJJ20053: ELECTRICAL TECHNOLOGY

TARIKH : 07 JUN 2024

MASA : 8.30 PAGI – 10.30 PAGI (2 JAM)

Kertas ini mengandungi **SEMBILAN (9)** halaman bercetak.

Struktur (4 soalan)

Dokumen sokongan yang disertakan : Formula

JANGAN BUKA KERTAS SOALAN INI SEHINGGA DIARAHKAN

(CLO yang tertera hanya sebagai rujukan)

SULIT

INSTRUCTION:

This section consists of **FOUR (4)** structured questions. Answer **ALL** questions.

ARAHAN :

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

QUESTION 1**SOALAN 1**

- CLO1 (a) Complete electric circuit is a closed end connection that can make current go through completely in which the current flows from source and back flow to sources again.
Litar elektrik yang lengkap ialah satu sambungan tertutup yang membolehkan arus mengalir dari bekalan kuasa dan kembali semula ke bekalan kuasa.
- i. Give a simple sketch and label the complete electric circuit
Berikan lakaran mudah dan labelkan litar elektrik yang lengkap
 [3 marks]
 [3 markah]
- ii. List **THREE (3)** basic electrical quantities and state the units
*Senaraikan **TIGA (3)** kuantiti elektrik asas dan nyatakan unitnya*
 [3 marks]
 [3 markah]
- CLO2 (b) A mini electric fan with 15A current and 10V supply was on for 25 minutes. Express the value of:
Kipas elektrik mini dengan arus 15A dan bekalan 10V dihidupkan selama 25 minit. Nyatakan nilai bagi:
- i. Power used, P
Kuasa yang digunakan, P
 [2 marks]
 [2 markah]

- ii. Energy used, E
Tenaga yang digunakan, E
 [4 marks]
 [4 markah]

- iii. Relate **TWO (2)** suitable instruments to measure the value of power
*Kaitkan **DUA (2)** alat yang sesuai untuk mengukur nilai kuasa*
 [2 marks]
 [2 markah]

- CLO2 (c) Referring to Figure 1(c), calculate:
Berdasarkan Rajah 1 (c), kirakan:

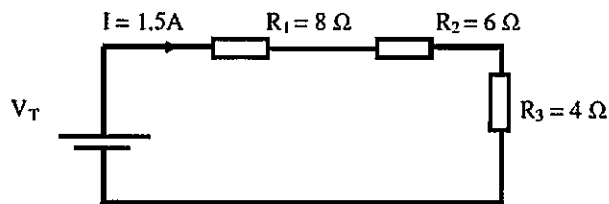


Figure 1(c) / Rajah 1(c)

- i. Total resistance, R_T
Jumlah rintangan, R_T
 [1 marks]
 [1 markah]
- ii. Voltage drop in resistor R_1 , R_2 and R_3
Kejatuhan voltan dalam perintang R_1 , R_2 dan R_3
 [6 marks]
 [6 markah]
- iii. Total voltage, V_T
Jumlah voltan, V_T
 [2 marks]
 [2 markah]
- iv. Value of R_T if resistor R_1 , R_2 and R_3 are connected in parallel
Nilai R_T jika perintang R_1 , R_2 dan R_3 di sambung secara selari
 [2 marks]
 [2 markah]

QUESTION 2

SOALAN 2

- CLO1 (a) List **THREE (3)** factors that affect the capacitance value in a capacitor.
*Senaraikan **TIGA (3)** faktor yang mempengaruhi nilai sesebuah pemuat.*
[6 marks]
[6 markah]
- CLO2 (b) Express the value of total inductance of three inductors $L_1=120\text{mH}$, $L_2=60\text{mH}$ and $L_3=50\mu\text{H}$ when the inductor is connected in:
Nyatakan nilai jumlah kearuhan bagi tiga pearuh $L_1=120\text{mH}$, $L_2=60\text{mH}$ dan $L_3=50\mu\text{H}$ apabila disambungkan secara:
- i. Series
Siri
[3 marks]
[3 markah]
- ii. Parallel
Selari
[4 marks]
[4 markah]
- CLO2 (c) An alternating current (AC) circuit with 240V, 50Hz is connected in series with the resistance of 100Ω , capacitance of $470\mu\text{F}$ and inductance of 330mH . Calculate:
Litar arus ulangalik (AU) dengan 240V, 50Hz disambung secara bersiri dengan rintangan 100Ω , kemuatan $470\mu\text{F}$ dan kearuhan 330mH . Kirakan:
- i. Impedance in the circuit, Z
Galangan dalam litar, Z
[4 marks]
[4 markah]

- ii. Current in the circuit, I
Arus dalam litar, I
[2 marks]
[2 markah]
- iii. Power factor, p.f and phase angle, θ
Faktor kuasa, P.f dan sudut fasa, θ
[4 marks]
[4 markah]
- iv. Power, P in kW
Kuasa, P dalam kW
[2 marks]
[2 markah]

QUESTION 3

SOALAN 3

- CLO1 (a) Describe **THREE (3)** factors that affect electromagnetic strength.
Senarai dan huraikan TIGA (3) faktor yang mempengaruhi kekuatan elektromagnet.
- [6 marks]
[6 markah]
- CLO2 (b) A current of 600mA is passed through a 550 turns coil wound at a toroid of mean diameter 20cm, express the value of:
Arus sebanyak 600mA mengalir melalui sebuah toroid yang mempunyai 550 lilitan dengan diameter 20cm, nyatakan nilai bagi:
- i. Magnetic field strength, H
Kekuatan medan magnet, H
- [4 marks]
[4 markah]
- ii. Flux density, B if the magnetic flux produced is 30mWb
Ketumpatan fluks, B sekiranya fluks magnet yang dihasilkan ialah 30mWb
- [4 marks]
[4 markah]
- CLO2 (c) A coil of 300 turns is wound uniformly on a ring of non-magnetic material. The ring has a mean circumference of 40cm and cross-sectional area of 4cm². If the current in the coil is 5A, calculate:
Satu gegelung 300 belitan dililit pada satu cincin tidak bermagnet. Cincin tersebut berlilitan 40cm dan luas keratan rentas cincin tersebut ialah 4cm². Jika arus mengalir pada gegelung tersebut ialah 5A, kirakan:

- | | | |
|------|--|-------------------------|
| i. | Magnetomotive force, F_m
<i>Daya gerak magnet, F_m</i> | [2 marks]
[2 markah] |
| ii. | Magnetic field strength, H
<i>Kekuatan medan magnet, H</i> | [3 marks]
[3 markah] |
| iii. | Flux density, B
<i>Ketumpatan fluks, B</i> | [3 marks]
[3 markah] |
| iv. | Magnetic flux, Φ
<i>Fluks magnet, Φ</i> | [3 marks]
[3 markah] |

QUESTION 4

SOALAN 4

- CLO1 (a) Describe **TWO (2)** types of AC machine.
Senarai dan huraikan DUA (2) jenis mesin AU.
- [6 marks]
[6 markah]
- CLO2 (b) A 5-pole, 3 phase, 50Hz induction motor runs at 1000 rev/min at full load.
Express the value of:
Motor aruhan 5 kutub, 3 fasa, 50Hz bergerak pada kelajuan 1000 putaran/minit pada beban penuh. Nyatakan nilai untuk:
- i. Synchronous speed, N_s
Kelajuan segerak, N_s
- [3 marks]
[3 markah]
- ii. Slip percentage, %S
Peratus gelinciran, %S
- [4 marks]
[4 markah]
- CLO2 (c) As an assistant engineer, you are given the task of calculating some quantities of a new machine with built-in transformer. The datasheet from the machine's manual book shows the following data:
Sebagai seorang pembantu jurutera, anda diberi tugas untuk menentukan dan mengira beberapa perkara untuk mesin baru yang dilengkapi dengan transformer. Lembaran data daripada buku manual mesin menunjukkan data berikut:
- Power consumed: 70kVA
Kuasa yang digunakan: 70kVA

Voltage Input/Output: 850V/225V

Voltan masukan/keluaran: 850V/225V

Frequency: 60Hz

Frekuensi: 60Hz

Number of Input Winding: 800 turns

Bilangan lilitan masukan: 800 lilitan

You are asked to calculate the following quantities:

Anda diminta untuk mengira perkara berikut:

- i. Number of secondary windings, N_s

Bilangan lilitan pada gegelung sekunder, N_s

[3 marks]

[3 markah]

- ii. Primary current, I_p

Arus pada gegelung primer, I_p

[3 marks]

[3 markah]

- iii. Secondary current, I_s

Arus pada gegelung sekunder, I_s

[3 marks]

[3 markah]

- iv. Maximum magnetic flux, Φ

Nilai fluks magnet maksima, Φ

[3 marks]

[3 markah]

SOALAN TAMAT

DJJ20053 – ELECTRICAL TECHNOLOGY

FORMULA

INTRODUCTION TO ELECTRICAL CIRCUITS $R = \frac{\rho l}{A} \quad C = \frac{Q}{V}$ $V = IR \quad P = IV$ $E = Pt$	ALTERNATING CURRENT CIRCUIT	AC MACHINES $N_s = \frac{120f}{P} \quad \%S = \frac{N_s - N_r}{N_s} \times 100$ $Nr = N_s(1 - S) \quad fr = Sf$ $E = 2.22K_d K_p f \theta Z$
SERIES $V_T = V_1 + V_2 + \dots + V_n$ $I_T = I_1 = I_2 = \dots = I_n$ $R_T = R_1 + R_2 + \dots + R_n$ $L_T = L_1 + L_2 + \dots + L_n$ $\frac{1}{C_T} = \frac{1}{C_1} + \frac{1}{C_2} + \dots + \frac{1}{C_n}$ $V_X = \frac{R_X}{R_T} V_T$	RL CIRCUIT $I = \frac{V}{Z}$ $V_L = IX_L$ $Z = \sqrt{R^2 + X_L^2}$ $\theta = \tan^{-1} \left[\frac{X_L}{R} \right]$ $\cos \theta = \frac{R}{Z}$	TRANSFORMER $\frac{V_P}{V_S} = \frac{N_P}{N_S} = \frac{I_S}{I_P} \quad E_1 = 4.44 f N_1 \Phi_m$ $E_2 = 4.44 f N_2 \Phi_m$ <i>Complex Power, S(VA) = VI</i> <i>Actual Power, P(W) = VI cos θ</i> <i>Re active Power, Q(VAR) = VI sin θ</i> $I = \frac{\text{Power}}{\text{Voltage}}$ <i>Power losses = Core lossess + $I_P^2 R_P + I_S^2 R_S$</i> <i>Output Power = Power × power factor</i> <i>Input Power = Output power + powerlosses</i> $\text{Efficiency, \%}\eta = \frac{\text{output power}}{\text{input power}} \times 100$
PARALLEL $V_T = V_1 = V_2 = \dots = V_n$ $I_T = I_1 + I_2 + \dots + I_n$ $\frac{1}{R_T} = \frac{1}{R_1} + \frac{1}{R_2} + \dots + \frac{1}{R_n}$ $\frac{1}{L_T} = \frac{1}{L_1} + \frac{1}{L_2} + \dots + \frac{1}{L_n}$ $C_T = C_1 + C_2 + \dots + C_n$ $I_X = \frac{R_T}{R_X} I_T$	RC CIRCUIT $I = \frac{V}{Z}$ $V_C = IX_C$ $Z = \sqrt{R^2 + X_C^2}$ $\theta = \tan^{-1} \left[\frac{X_C}{R} \right]$ $\cos \theta = \frac{R}{Z}$	ELECTROMAGNET $H = \frac{Fm}{l} = \frac{NI}{l}$ $B = \frac{\Phi}{A}$ $B = \mu H$ $\mu = \mu_o \mu_r$ $S = \frac{Fm}{\Phi} = \frac{l}{\mu A}$
	RLC CIRCUIT $I = \frac{V}{Z}$ $V_L = IX_L \quad V_C = IX_C \quad V_R = IR$ $Z = \sqrt{R^2 + (X_L - X_C)^2}$ $\theta = \tan^{-1} \left[\frac{X_L - X_C}{R} \right]$ $\cos \theta = \frac{R}{Z}$	