

**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:*

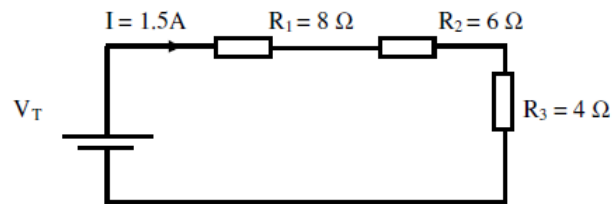


Figure 1(c) / Rajah 1(c)

- 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  $100\Omega$ , capacitance of  $470\mu\text{F}$  and inductance of  $330\text{mH}$ . Calculate:  
*Litar arus ulangalik (AU) dengan 240V, 50Hz disambung secara bersiri dengan rintangan  $100\Omega$ , kemuatan  $470\mu\text{F}$  dan kearuhan  $330\text{mH}$ . 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,  $\theta$   
*Faktor kuasa, P.f dan sudut fasa,  $\theta$*
- [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 4cm<sup>2</sup>. 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 4cm<sup>2</sup>. Jika arus mengalir pada gegelung tersebut ialah 5A, kirakan:*

- i. Magnetomotive force,  $F_m$   
*Daya gerak magnet,  $F_m$*
- [2 marks]  
[2 markah]
- ii. Magnetic field strength,  $H$   
*Kekuatan medan magnet,  $H$*
- [3 marks]  
[3 markah]
- iii. Flux density,  $B$   
*Ketumpatan fluks,  $B$*
- [3 marks]  
[3 markah]
- iv. Magnetic flux,  $\Phi$   
*Fluks magnet,  $\Phi$*
- [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,  $\Phi$

*Nilai fluks magnet maksima,  $\Phi$*

[3 marks]

[3 markah]

**SOALAN TAMAT**

# DJJ20053 – ELECTRICAL TECHNOLOGY

## FORMULA

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