

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 : 2022/2023

DJJ20053: ELECTRICAL TECHNOLOGY

TARIKH : 14 JUN 2023

MASA : 8.30 PG – 10.30 PG (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 berstruktur. Jawab SEMUA soalan.

QUESTION 1**SOALAN 1**

CLO1

(a) Define the following terms and state their units.

Takrifkan istilah-istilah di bawah beserta unit.

i. Electromotive force (emf)

Daya gerak elektrik (dge)

[2 marks]

[2 markah]

ii. Current

Arus

[2 marks]

[2 markah]

iii. Resistance

Rintangan

[2 marks]

[2 markah]

CLO2

(b) An electric oven consumes 1.2kW of power. If the supply voltage is 240V, express the value of:

Sebuah ketuhar elektrik menggunakan kuasa sebanyak 1.2kW. Sekiranya sumber voltan ialah 240V, nyatakan nilai bagi:

i. Current flown in the oven, I

Arus yang mengalir dalam ketuhar tersebut, I

[2 marks]

[2 markah]

- ii. Resistance of the heating coil, R
Rintangan pada gegelung pemanas, R

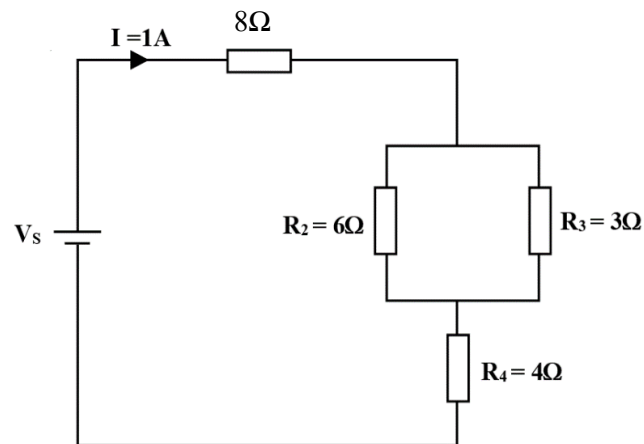
[3 marks]

[3 markah]

- iii. Energy (Joule) consumed in 45 minutes
Tenaga (Joule) yang digunakan dalam masa 45 minit

[3 marks]

[3 markah]

Figure 1(c)/ *Rajah 1(c)*

CLO2

- (c) Referring to the combination circuit in **Figure 1(c)**, calculate:
*Merujuk kepada litar gabungan dalam **Rajah 1(c)**, kirakan:*

- i. The total power, P_T
Jumlah Kuasa, P_T

[5 marks]

[5 markah]

- ii. The voltage drop at R_1 and R_4 resistor
Voltan susut pada perintang R_1 dan R_4

[4 marks]

[4 markah]

- iii. The supply voltage (V_s)
Voltan bekalan (V_s)

[2 marks]

[2 markah]

QUESTION 2**SOALAN 2**

CLO1

- (a) State **THREE (3)** differences between Inductor and Capacitor in term of function, symbols, and units.
*Nyatakan **TIGA (3)** perbezaan di antara Peraruh dan Pemuat merujuk kepada fungsi, simbol dan unit.*

[6 marks]

[6 markah]

CLO2

- (b) Express the total value of capacitance for **FOUR (4)** capacitors with each of them having $120\mu\text{F}$ of capacitance connected in:
*Nyatakan jumlah kemuatan bagi **EMPAT (4)** pemuat dengan nilai kemuatan bagi setiap pemuat adalah $120\mu\text{F}$ apabila ia disambung secara:*

- i. Series
Siri

[4 marks]

[4 markah]

- ii. Parallel
Selari

[3 marks]

[3 markah]

CLO2

(c) A RL series circuit has a 10Ω resistor, a 0.2H inductor and it is supplied with 250V , 50Hz AC.

Sebuah litar siri RL mempunyai $10\ \Omega$ perintang, $0.2\ \text{H}$ peraruh dan voltan bekalan 250V , 50Hz AC.

i. Sketch the diagram of the series circuit

Lakarkan gambarajah litar sesiri tersebut

[2 marks]

[2 markah]

Calculate:

Kirakan:

ii. Impedance, Z

Galangan, Z

[4 marks]

[4 markah]

iii. Current, I

Arus, I

[2 marks]

[2 markah]

iv. Phase angle, Θ

Sudut fasa, Θ

[2 marks]

[2 markah]

v. Power factor, $\cos \Theta$

Faktor kuasa, $\cos \Theta$

[2 marks]

[2 markah]

QUESTION 3**SOALAN 3**

- CLO1 (a) Describe **THREE (3)** factors that affect the strength of magnetic field.
*Huraikan **TIGA (3)** faktor yang mempengaruhi kekuatan medan magnet.*
- [6 marks]
[6 markah]
- CLO2 (b) A current of 500mA is passed through a 600 turns coil wound at a toroid of mean diameter 10cm, express the value of:
Arus sebanyak 500mA mengalir menerusi sebuah toroid yang mempunyai 600, lilitan dengan diameter 10cm, nyatakan nilai bagi:
- i. Magnetic field strength, H
Kekuatan medan magnet, H
- [4 marks]
[4 markah]
- ii. Flux density, B if the flux produced is 20mWb
Ketumpatan fluks sekiranya fluks magnet yang dihasilkan ialah 20mWb
- [4 marks]
[4 markah]
- CLO2 (c) A ring iron core has a mean circumference of 250 mm and a cross sectional area of 110 mm². It is wound with 2000 turns. It was found through measurement, that the value of fluxes in the iron is 0.2 mWb when 65 mA current flows through the winding. Calculate:
Satu teras besi berbentuk gelang yang mempunyai purata ukurlilit sebanyak 250 mm dan luas keratan rentas ialah 110 mm². Teras itu dililit dengan 2000 lilitan pengalir. Melalui pengukuran, didapati 0.2mWb fluks wujud apabila 65mA melalui lilitan tersebut. Kirakan:

Given the permeability of free space, $\mu_0=4\pi \times 10^{-7}$ H/m

Diberi nilai ketelapan ruang bebas, $\mu_0=4\pi \times 10^{-7}$ H/m

i. Magnetic field strength, H

Kekuatan medan magnet, H

[3 marks]

[3 markah]

ii. Absolute permeability, μ_a

Ketelapan bandingan, μ_a

[4 marks]

[4 markah]

iii. Relative permeability, μ_r

Ketelapan bandingan, μ_r

[2 marks]

[2 markah]

iv. Iron core reluctance, S

Engganan teras besi, S

[2 marks]

[2 markah]

QUESTION 4

SOALAN 4

CLO1

(a) State **TWO (2)** differences between DC and AC motors.

*Nyatakan **DUA (2)** perbezaan di antara motor DC dan AC.*

[4 marks]

[4 markah]

CLO2

- (b) A 5 pole, 300 V, 50 Hz alternating current (AC) generator runs in a speed of 750 rpm, has 4 slots and 15 conductors/slots. If the flux used is 15mWb, express the value of:

Sebuah penjana AC 5 kutub, 300V, 50Hz bergerak dengan kelajuan sebanyak 750rpm, 4 slot dan mempunyai 15 konduktor/slot. Jika diberi nilai flux yang digunakan adalah 15mWb, nyatakan nilai bagi:

- i. Total number of conductors in the generator, Z
Jumlah konduktor dalam penjana, Z

[2 marks]

[2 markah]

- ii. Percentage slip in full load, % S
Peratus slip dalam keadaan beban penuh, % S

[4 marks]

[4 markah]

- iii. Rotor frequency, f_r
Frekuensi rotor, f_r

[2 marks]

[2 markah]

CLO2

- (c) A 100kVA, 4000 V/200 V, 50Hz single phase transformer has 100 secondary turns. Calculate:

Sebuah pengubah satu fasa 100kVA, 4000 V/200 V, 50Hz mempunyai lilitan sekunder sebanyak 100 lilitan. Kirakan:

- i. The primary and secondary current, I_P & I_S
Arus primer dan arus sekunder, I_P & I_S

[4 marks]

[4 markah]

- ii. The number of primary turns, N_P
Bilangan lilitan primer, N_P
- [3 marks]
[3 markah]
- iii. The maximum value of flux, ϕ
Nilai maksimum fluks, ϕ
- [2 marks]
[2 markah]
- iv. The turns of ratio required
Nisbah lilitan yang diperlukan
- [2 marks]
[2 markah]
- v. Referring to answer of Q4(c) iv, draw the type of transformer
Merujuk jawapan kepada Q4(c) iv, lukis jenis transformer.
- [2 marks]
[2 markah]

SOALAN TAMAT

DJJ20053 – ELECTRICAL TECHNOLOGY

FORMULA

INTRODUCTION TO ELECTRICAL CIRCUITS $R = \frac{\rho \ell}{A}$ $V = IR$ $P = IV$ $E = Pt$ $C = \frac{Q}{V}$ KIRCHOFF'S LAW $V_j = V_1 + V_2 + V_3$ $\Sigma I_{IN} = \Sigma I_{OUT}$ $I_1 = I_2 + I_3$ SERIES $V_T = V_1 + V_2 + \dots + V_n$ $I_T = I_1 = I_2 = \dots = I_n$ $R_T = R_1 + R_2 + \dots + R_n$ $L_T = L_1 + L_2 + \dots + L_n$ $\frac{1}{C_T} = \frac{1}{C_1} + \frac{1}{C_2} + \dots + \frac{1}{C_n}$ $V_x = \frac{R_x}{R_T} V_T$ PARALLEL $V_T = V_1 = V_2 = \dots = V_n$ $I_T = I_1 + I_2 + \dots + I_n$ $\frac{1}{R_T} = \frac{1}{R_1} + \frac{1}{R_2} + \dots + \frac{1}{R_n}$ $\frac{1}{L_T} = \frac{1}{L_1} + \frac{1}{L_2} + \dots + \frac{1}{L_n}$ $C_T = C_1 + C_2 + \dots + C_n$ $I_x = \frac{R_T}{R_x} I_T$	ALTERNATING CURRENT CIRCUIT RL CIRCUIT $I = \frac{V}{Z}$ $V_L = IX_L$ $Z = \sqrt{R^2 + X_L^2}$ $\theta = \tan^{-1} \left[\frac{X_L}{R} \right]$ $\text{Cos } \theta = \frac{R}{Z}$ RC CIRCUIT $I = \frac{V}{Z}$ $V_C = IX_C$ $Z = \sqrt{R^2 + X_C^2}$ $\theta = -\tan^{-1} \left[\frac{X_C}{R} \right]$ $\text{Cos } \theta = \frac{R}{Z}$ RLC CIRCUIT $I = \frac{V}{Z}$ $V_L = IX_L$ $V_R = IR$ $V_C = IX_C$ $Z = \sqrt{R^2 + (X_L - X_C)^2}$ $\theta = \tan^{-1} \left[\frac{X_L - X_C}{R} \right]$ $\text{Cos } \theta = \frac{R}{Z}$	AC MACHINES $N_s = \frac{120f}{P}$ $\%S = \frac{N_s - N_r}{N_s} \times 100$ $N_r = N_s(1 - S)$ $f_r = Sf$ $E = 2.22K_d K_p f \phi Z$ TRANSFORMER $\frac{V_p}{V_s} = \frac{N_p}{N_s} = \frac{I_s}{I_p}$ $E_1 = 4.44 f N_1 \Phi_m$ $E_2 = 4.44 f N_2 \Phi_m$ Complex Power, S (VA) = VI Actual Power, P (W) = VI cos θ Reactive Power, Q (VAR) = VI sin θ I = $\frac{\text{Power}}{\text{Voltage}}$ Power losses = Core losses + $I_p^2 R_p + I_s^2 R_s$ Output power = Power x power factor Input power = output power + power losses Efficiency, % η = $\frac{\text{output power}}{\text{Input power}} \times 100$ ELECTROMAGNET $H = \frac{Fm}{l} = \frac{NI}{l}$ $B = \frac{\Phi}{A}$ $B = \mu H$ $\mu = \mu_o \mu_r$ $S = \frac{Fm}{\Phi} @ \frac{l}{\mu A}$
---	--	---