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 I : 2023/2024

DJJ20053 : ELECTRICAL TECHNOLOGY

TARIKH : 2 JANUARI 2024
MASA : 8.30 AM – 10.30 PM (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)

INSTRUCTION:

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

ARAHAN:

*Kertas ini mengandungi **EMPAT (4)** soalan berstruktur. Jawab **SEMUA** soalan.*

QUESTION 1

SOALAN 1

CLO 1

(a) Define electrical circuit and state **TWO (2)** types of electric circuit.

*Takrifkan litar elektrik dan nyatakan **DUA (2)** jenis litar elektrik.*

[6 marks]

[*6 markah*]

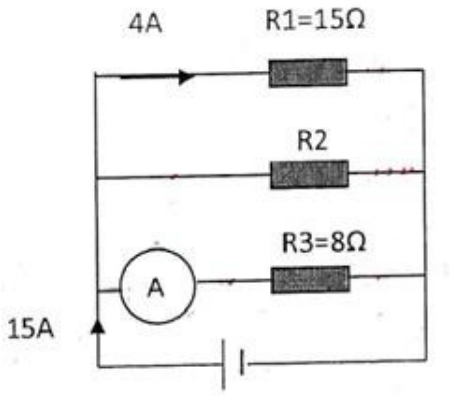

Figure 1 (a) : Electrical Circuit

Rajah 1(a) : Litar Elektrik

CLO 2

(b) Referring to **Figure 1(a)**, express the value of:

*Berdasarkan kepada **Rajah 1(a)**, tentukan nilai bagi:*

i. Ammeter reading

Bacaan pada ammeter

[3 marks]

[*3 markah*]

ii. Resistance of R_2
Rintangan R_2

[3 marks]
[*3 markah*]

iii. Voltage drop across R_2
Voltan susut pada R_2

[2 marks]
[*2 markah*]

CLO 2

(c) A housewife bought a new rice cooker of brand X at an electrical store. **Table 1 (c)** shows the specifications of the rice cooker. Referring to **Table 1 (c)**, calculate:
Seorang surirumah telah membeli sebuah periuk nasi baharu berjenama X di sebuah kedai elektrik. ***Jadual 1(c)*** *menunjukkan spesifikasi periuk nasi tersebut. Berdasarkan* ***Jadual 1(c)****, kirakan:*

Table 1 (c) : Specifications Of Rice Cooker Brand X
Jadual 1(c): Spesifikasi Peruk Nasi Jenama X

Model ***Model***	**PSCL301**
Voltage *Voltan*	240V,50Hz
Power Kuasa	3.45kW
Capacity *Kapasiti*	3L
Weight *Berat*	2.4KG

i. Current, I
Arus, I

[4 marks]
[*4 markah*]

ii. Resistance, R
Rintangan, R

[3 marks]
[*3 markah*]

iii. Energy, if the rice cooker is switched on for half an hour, E
Kuasa, jika periuk digunakan selama setengah jam, E

[4 marks]
[*4 markah*]

QUESTION 2
SOALAN 2

CLO 1 (a) Define and give the schematic diagram for both capacitor and inductor.
Takrifkan dan berikan rajah skematik bagi pemuat dan peraruh.

[6 marks]
[*6 markah*]

CLO 2 (b) Express the value of total capacitance of three capacitors, C_1 = 2 μF, C_2 = 4 μF, C_3 = 4 μF which are connected in:
Nyatakan nilai bagi jumlah kemuatan bagi tiga pemuat, C1 = 2 μF, C2 = 4 μF, C3 = 4 μF yang disambungkan secara:

i. Series
Sesiri

[4 marks]
[*4 markah*]

ii. Parallel
S*elari*

[3 marks]
[*3 markah*]

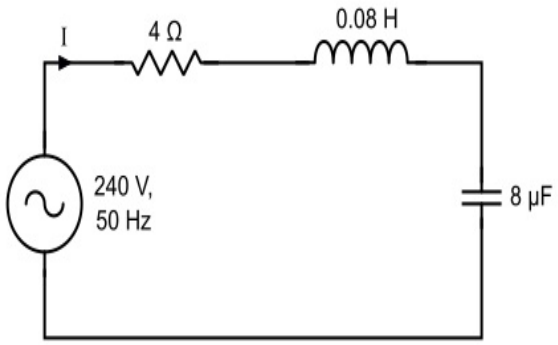

Figure 2 (c) : RLC Circuit

Rajah 2 (c) : Litar RLC

CLO 2

(c) RLC circuit as in **Figure 2 (c)** is the combination of resistor, inductor and capasitor in series with AC supply. Calculate:

*Litar RLC seperti dalam **Rajah 2 (c)** ialah gabungan perintang, peraruh dan pemuat secara bersiri dengan bekalan AC. Kirakan:*

i. Impedance, Z

Galangan, Z

[4 marks]

[*4 markah*]

ii. Current,I

Arus, I

[2 marks]

[*2 markah*]

iii. Phase angle,~~Θ~~

Sudut fasa, ~~Θ~~

[2 marks]

[*2 markah*]

iv. Power factor, pf

Faktor kuasa, pf

[2 marks]

[*2 markah*]

v. Real power, P
Kuasa sebenar,P

[2 marks]
[*2 markah*]

QUESTION 3
SOALAN 3

CLO 1 (a) State **THREE (3)** characteristics of magnetic field lines.
*Nyatakan **TIGA (3)** ciri-ciri medan magnet.*

[6 marks]
[*6 markah*]

CLO 2 (b) A mild steel ring has a radius of 60mm and a cross sectional area of 500mm^2. A current of 0.3A flows in a coil wound uniformly around the ring and the flux produced is 0.01mWb. If the relative permeability is 300, express the value of:
Gelang keluli lembut mempunyai jejari 60mm dan luas keratan rentas 500mm^2. Arus 0.3A mengalir dalam gegelung dililit secara seragam di sekeliling gelang dan fluks yang dihasilkan ialah 0.01mWb. Jika kebolehtelapan relatif ialah 300, nyatakan nilai bagi:

i. Flux density, *B*
Ketumpatan fluks, B

[3 marks]
[*3 markah*]

ii Reluctance of the mild steel, S
Keengganan keluli lembut,S

[3 marks]
[*3 markah*]

iii. Magnetic field strength, H
Kekuatan medan magnet, H

[2 marks]
[*2 markah*]

CLO 2 (c) A stainless steel cylinder of 150cm length and crossed sectional area 5cm^2 is wounded with 1000 turns of coil and 6A current flowing through it. The value of relative permeability is 1500, calculate:
Sebuah silinder keluli tahan karat dengan panjang 150 cm dan luas keratan rentas 5 cm^2 dililit dengan 1000 lilitan gegelung dan arus 6A mengalir melaluinya. Nilai kebolehtelapan relatif ialah 1500, hitung:

i. Magnetomotive force, Fm
Daya gerak magnet,Fm.

[2marks]
[*2 markah*]

ii. Magnetic field strength, H
Kekuatan medan magnet, H

[3 marks]
[*3 markah*]

iii. Flux density, B
Ketumpatan fluks,B

[3 marks]
[*3markah*]

iv. The value of flux, Φ
Nilai fluks, Φ

[3 marks]
[*3 markah*]

QUESTION 4

SOALAN 4

CLO1 *(a)* State **TWO (2)** basic parts of AC Machine and give the structure diagram for each.
*Nyatakan **DUA (2)** bahagian asas struktur Mesin AU dan berikan rajah struktur setiap satunya.*

[6 marks]
[*6 markah*]

CLO 2 (b) The frequency of the supply to the stator of 8-poles induction motor is 50 Hz, the rotor frequency is 3 Hz with 15 conductors/slots. Express the value of:
Frekuensi yang dibekalkan pada pemegun, motor aruan 8 kutub adalah 50Hz, frekuensi pemutar adalah 3 Hz dengan 15 konduktor/slot. Nyatakan nilai bagi:

i. Synchronous speed, Ns
Kelajuan segerak, Ns

[2 marks]
[*2 markah*]

ii. Percentage of slip, %S
Peratus slip, % S

[3 marks]
[*3 markah*]

iii. Rotor speed, Nr
Kelajuan rotor, Nr

[2 marks]
[*2 markah*]

CLO 2

(c) A single phase transformer has a voltage ratio of 6:1 and high voltage winding is supplied at 540V. The secondary winding provides a full load current of 30A. Neglecting losses, calculate:

Pengubah fasa tunggal mempunyai nisbah voltan 6:1 dan lilitan voltan tinggi dibekalkan pada 540V. Lilitan sekunder menyediakan arus beban penuh 30A. Abaikan kehilangan, hitungkan:

i. Secondary voltage, V_S
Voltan sekunder, V_S

[3 marks]
[*3 markah*]

ii. Power supplied to load, P_S
Kuasa pada beban, P_S

[2 marks]
[*2 markah*]

iii. Primary current, I_P
Arus primer, I_P

[3 marks]
[*3 markah*]

iv. Type of transformer
Jenis pengubah

[4 marks]
[*4 markah*]

SOALAN TAMAT

DJJ20053 – ELECTRICAL TECHNOLOGY

FORMULA

INTRODUCTION TO ELECTRICAL CIRCUITS

$$R = \frac{\rho \ell}{A} \qquad V = IR$$

$$P = IV \qquad E = Pt$$

$$C = \frac{Q}{V}$$

KIRCHOFF'S LAW

$V_J = V_1 + V_2 + V_3$

$\Sigma I_{IN} = \Sigma I_{OUT}$

$I_1 = I_2 + I_3$

SERIES

$V_T = V_1 + V_2 + \ldots\ldots + V_n$
$I_T = I_1 = I_2 = \ldots\ldots = I_n$
$R_T = R_1 + R_2 + \ldots\ldots\ldots + R_n$
$L_T = L_1 + L_2 + \ldots\ldots + L_n$
$\frac{1}{C_T} = \frac{1}{C_1} + \frac{1}{C_2} + \ldots\ldots + \frac{1}{C_n}$
$Vx = \frac{R_x}{R_T} V_T$

PARALLEL

$V_T = V_1 = V_2 = \ldots\ldots = Vn$
$I_T = I_1 + I_2 + \ldots\ldots\ldots + I_n$
$\frac{1}{R_T} = \frac{1}{R_1} + \frac{1}{R_2} + \ldots\ldots + \frac{1}{R_n}$
$\frac{1}{L_T} = \frac{1}{L_1} + \frac{1}{L_2} + \ldots\ldots + \frac{1}{L_n}$
$C_T = C_1 + C_2 + \ldots\ldots + C_n$
$Ix = \frac{R_T}{R_x} I_T$

ALTERNATING CURRENT CIRCUIT

RL CIRCUIT

$I = \frac{V}{Z}$
$V_L = IX_L$
$Z = \sqrt{R^2 + X_L^{\ 2}}$
$\theta = \tan^{-1}\left[\frac{X_L}{R}\right]$
$Cos\theta = \frac{R}{Z}$

RC CIRCUIT

$I = \frac{V}{Z}$
$V_C = IX_C$
$Z = \sqrt{R^2 + X_C^{\ 2}}$
$\theta = -\tan^{-1}\left[\frac{X_C}{R}\right]$
$Cos\theta = \frac{R}{Z}$

RLC CIRCUIT

$I = \frac{V}{Z}$
$V_L = IX_L \qquad V_R = IR$ $V_C = IX_C$
$Z = \sqrt{R^2 + (X_L - X_C)^2}$
$\theta = \tan^{-1}\left[\frac{X_L - X_C}{R}\right]$
$Cos\theta = \frac{R}{Z}$

AC MACHINES

$$N_s = \frac{120f}{P} \qquad \%S = \frac{N_s - N_r}{N_s} \times 100$$

$$N_r = Ns(1 - S) \qquad f_r = Sf$$

$$E = 2.22 K_d K_p f \phi Z$$

TRANSFORMER

$$\frac{V_p}{V_s} = \frac{N_p}{N_s} = \frac{I_s}{I_p} \qquad E_1 = 4.44 f N_1 \Phi_m$$

$$E_2 = 4.44 f N_2 \Phi_m$$

Complex Power, S (VA) = VI

Actual Power,P (W) = $VI \cos\theta$

Reactive Power,Q (VAR) = $VI \sin\theta$

I = Power / Voltage

Power losses = Core losses + $Ip^2Rp + Is^2Rs$

Output power = Power x power factor

Input power = output power + power losses

Efficiency,%η = output power / Input power x 100

ELECTROMAGNET

$$H = \frac{Fm}{l} = \frac{NI}{l}$$

$$B = \frac{\Phi}{A}$$

$$B = \mu H$$

$$\mu = \mu_o \mu_r$$

$$S = \frac{Fm}{\Phi} @ \frac{l}{\mu A}$$