SULIT

POLITEKNIK MALAYSIA

BAHAGIAN PEPERIKSAAN DAN PENILAIAN
JABATAN PENDIDIKAN POLITEKNIK
KEMENTERIAN PENDIDIKAN TINGGI

JABATAN KEJURUTERAAN MEKANIKAL

PEPERIKSAAN AKHIR

SESI JUN 2016

DJJ2022: ELECTRICAL TECHNOLOGY

TARIKH : 03 NOVEMBER 2016
MASA : 2.30 PM - 4.30 PM (2 JAM)

Kertas ini mengandungi **TUJUH (7)** halaman bercetak.
Empat (4) soalan berstruktur
Dokumen sokongan yang disertakan : Kertas Graf, **Formula** dsb / Tiada

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JANGAN BUKA KERTAS SOALAN INI SEHINGGA DIARAHKAN

(CLO yang tertera hanya sebagai rujukan)

SULIT

INSTRUCTION:

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

ARAHAN:

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

QUESTION 1

SOALAN 1

CLO1
C1

(a) List **FOUR (4)** factors that influence the value of resistance

*Senaraikan **EMPAT (4)** faktor yang mempengaruhi nilai rintangan*

[4 marks]

[*4 markah*]

CLO1
C2

(b) A bread maker with 5kW power, 230 voltage is used for baking 25 breads for half an hour. Calculate:

Pembakar Roti dengan kuasa 5kW , 230 voltan digunakan untuk membakar 25 roti selama setengah jam. Kira:

i. Current (I)

Arus

[2 marks]

[*2 markah*]

ii. Resistance (R)

Rintangan

[2 marks]

[*2 markah*]

iii. Electrical energy if the circuit is being used for half an hour.

Tenaga elektrik jika litar digunakan selama setengah jam.

[2 marks]

[*2 markah*]

CLO1
C4

(c) Based on Figure 1(c), determine.
Berdasarkan Rajah 1(c), tentukan:

i. Total resistance, R_T
Jumlah rintangan, R_T

ii. Total current, I_T
Jumlah arus, I_T

iii. Current flow through resistor 3Ω, I_2 and resistor 6Ω, I_3
Arus melalui perintang 3Ω, I_2 dan perintang 6Ω, I_3

iv. Voltage drop through resistor 2Ω
Voltan susut melalui perintang 2Ω

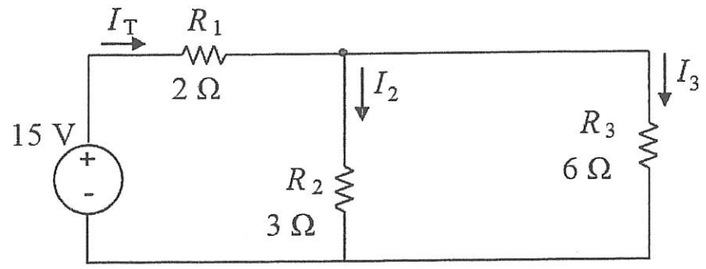

Figure 1(c) / *Rajah 1(c)*

[15 marks]
[*15 markah*]

QUESTION 2
SOALAN 2

CLO1
C1

(a) State **THREE (3)** factors affecting the value of the capacitance of a capacitor in electrical circuit.

*Nyatakan **TIGA (3)** faktor yang mempengaruhi nilai kemuatan pemuat dalam litar elektrik.*

[5 marks]
[*5 markah*]

CLO1
C2

(b) An Alternating current circuit has $50<30^{o}\Omega$ impedance, assuming the frequency is 50Hz. Determine the AC circuit, whether it is RL or RC.

Sebuah litar arus ulangalik mempunyai galangan $50<30^{o}\Omega$, dengan mengaggap frekuensi 50Hz. Tentukan litar AU tersebut samada ianya RC atau RL.

[5 marks]
[*5 markah*]

CLO1
C4

(c) Series RLC circuit with 50Ω, 10mH and 200μF. Supplied with AC 240 V with 50Hz frequency. Calculate:

Litar siri RLC dengan 50Ω,10mH dan 200μF. Dibekalkan dengan bekalan AU 240V dengan frekuensi 50Hz. Kirakan:

i. Total Impedance
Jumlah galangan

ii. Total current in the circuit
Jumlah arus dalam litar

iii. Voltage drop at each components; V_R, V_L and V_C
Kejatuhan voltan pada setiap komponen; V_R, V_L and V_C

[15 marks]
[*15 markah*]

QUESTION 3

SOALAN 3

CLO1
C2

(a) There are four factors that affect electromagnetic strength.
Terdapat empat faktor yang mempengaruhi kekuatan electromagnet.

i. Explain **FOUR (4)** factors which influence the electromagnetic strength.
*Terangkan **EMPAT (4)** faktor yang mempengaruhi kekuatan elektromagnet.*

[8 marks]
[*8 markah*]

ii. A current of 500mA is passed through a 600 turn coil wound at a toroid of mean diameter 10cm. Calculate the magnetic field strength.

Arus 500mA mengalir melalui 600 lilitan gegelung yang dililit pada toroid yang mempunyai diameter 10cm. Kirakan kekuatan medan magnet.

[4 marks]
[*4 markah*]

CLO1
C3

(b) A core of stainless steel of 50cm length and cross sectional area 4 cm^2 is wounded with 1000 turns of coil and 5A current flowing through it. The value of relative permeability is 1200, calculate:

Satu bar besi teras mempunyai panjang 50cm dan luas permukaan 4cm^2 dililit *dengan 1000 lilitan pengalir dan arus sebanyak 5A melaluimya. Nilai ketelapan relatif adalah 1200, kira:*

i. Magneto motive force, Fm
Daya gerak magnet, Fm

[2 marks]
[*2 markah*]

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

[2 marks]
[*2 markah*]

iii. Absolute permeability, μ
Ketelapan sebenar, μ

[2 marks]
[*2 markah*]

iv. Flux density, B
Ketumpatan Fluks, B

[2 marks]
[*2 markah*]

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

[2 marks]
[*2 markah*]

vi. Reluctance, S
Engganan, S

[3 marks]
[*3 markah*]

QUESTION 4

SOALAN 4

CLO1
C1

(a) State **TWO (2)** types of transformer losses.
*Nyatakan **DUA (2)** jenis kehilangan dalam pengubah.*

[5 marks]
[*5 markah*]

CLO1
C2

(b) Differentiate between rotor and stator
Bezakan rotor dan stator

[5 marks]
[*5 markah*]

CLO1
C3

(c) A single phase transformer with 400 kVA rating has a primary winding resistance of 0.5Ω and a secondary winding resistance of 0.001Ω. The iron loss is 2.5 kW and the primary and secondary voltages are 5 kV and 320 V respectively. If the power factor of the load is 0.85,calculate :

Sebuah pengubah fasa tunggal dengan kuasa ketara 400kVA mempunyai rintangan belitan primer 0.5 Ω dan rintangan belitan sekunder 0.001Ω. Kehilangan teras besi yang dialami pengubah ialah 2.5 kW dan nilai voltan primer dan sekunder masing-masing adalah 5 kV and 320 V. Jika faktor kuasa pengubah ini adalah 0.85, tentukan nilai:

i. The Primary current (Ip)
Arus primer (Ip)

ii. The Secondary current (Is)
Arus sekunder (Is)

iii. Power losses
Kehilangan kuasa

iv. Output power
Kuasa keluaran

v. Input power
Kuasa masukan

vi. The efficiency of the transformer when the transformer is on a full load stage.
Kecekapan pengubah jika pengubah berada dalam keadaan beban penuh.

[15 marks]
[*15 markah*]

SOALAN TAMAT

POLITEKNIK MALAYSIA

DJJ2022- ELECTRICAL TECHNOLOGY

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

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

PARALLEL

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

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

AC MACHINES

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

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

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

Actual Power,P (W) = $\sqrt{3}\, V_L I_L \cos\theta$

Reactive Power,Q (VAR) = $\sqrt{3}\, V_L I_L \sin\theta$

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

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

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

$B = \mu H$

$\mu = \mu_o \mu_r$

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