SULIT

POLITEKNIK MALAYSIA

BAHAGIAN PEPERIKSAAN DAN PENILAIAN
JABATAN PENDIDIKAN POLITEKNIK DAN KOLEJ KOMUNITI
KEMENTERIAN PENDIDIKAN MALAYSIA

JABATAN KEJURUTERAAN MEKANIKAL

PEPERIKSAAN AKHIR

SESI JUN 2018

DJJ2022: ELECTRICAL TECHNOLOGY

TARIKH : 17 NOVEMBER 2018
MASA : 8.30 PAGI - 10.30 PAGI (2 JAM)

Kertas ini mengandungi **TUJUH (7)** 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.*

CLO1
C1

QUESTION 1

SOALAN 1

(a) Define the following terms of basic electrical quantities :

Takrifkan istilah-istilah kuantiti asas elektrik yang berikut :

i. Electrical Charge

Cas Elektrik

[2 marks]

[*2 markah*]

ii. Current

Arus

[2 marks]

[*2 markah*]

iii. Resistivity

Kerintangan

[2 marks]

[*2 markah*]

CLO1
C2

(b) Explain **FOUR (4)** factors that affect the value of resistance in a conductor.

*Terangkan **EMPAT (4)** faktor yang mempengaruhi nilai rintangan dalam pengalir.*

[10 marks]

[*10 markah*]

CLO1
C3

(c) Referring to the circuit in **Figure 1(c),** the given values are $R_1 = 15\Omega$, $R_2 = 1k\Omega$, $R_3 = 100\Omega$, $R_4 = 150\Omega$ and $V_T = 12V$. Calculate :

*Merujuk kepada litar pada **Rajah 1(c),** nilai-nilai yang diberi adalah $R_1 = 15\Omega$, $R_2 = 1k\Omega$, $R_3 = 100\Omega$, $R_4 = 150\Omega$ and $V_T = 12V$. Kirakan:*

i. Total resistance, R_T

Jumlah rintangan, R_T

[4 marks]

[*4 markah*]

ii. Total Current, I_T

Jumlah arus, I_T

[2 marks]

[*2 markah*]

iii. Current flown through R_4 using the Current Divider Law, I_4

Arus yang melalui R_4 dengan menggunakan Hukum Pembahagi Arus, I_4

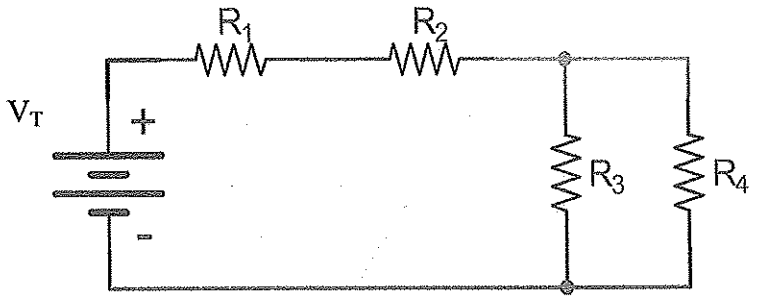

Figure 1 ***(c) / Rajah 1(c)***

[3 marks]

[*3 markah*]

QUESTION 2
SOALAN 2

CLO1
C1

(a) State the definition and symbol for the following electronic components:
Nyatakan definisi dan simbol untuk komponen elektronik di bawah:

i. Inductor / *Peraruh*

[2.5 marks]
[*2.5 markah*]

ii. Capacitor / *Pemuat*

[2.5 marks]
[*2.5 markah*]

CLO1
C2

(b) With the aid of a diagram, explain the phenomenon of mutual inductance.
Dengan berbantukan gambarajah, terangkan fenomena aruhan saling.

[8 marks]
[*8 markah*]

CLO1
C3

(c) Referring to the circuit in **Figure 2 (c),** calculate :
*Merujuk kepada litar pada **Rajah 2(c),** kirakan :*

i. Impedance, Z / *Galangan, Z*

[3 marks]
[*3 markah*]

ii. Current, I / *Arus, I*

[3 marks]
[*3 markah*]

iii. Phase angle, θ / *Sudut fasa,* θ

[3 marks]
[*3 markah*]

iv. Power factor, Cos θ / *Faktor kuasa, Cos* θ

[3 marks]
[*3 markah*]

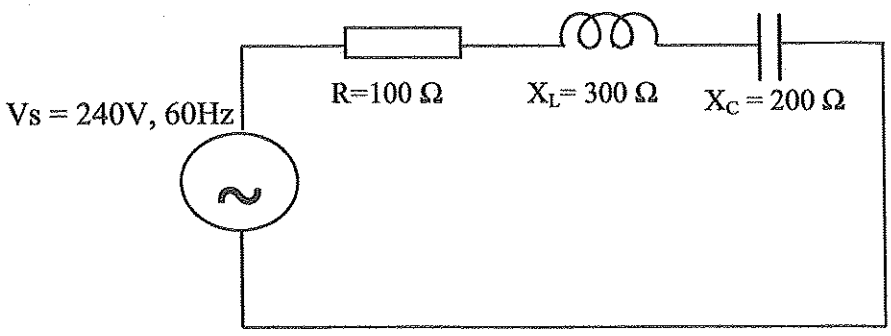

Figure 2 (c) / *Rajah 2* (c)

QUESTION 3

SOALAN 3

CLO1
C1

(a) State the definition, symbol and unit for the following magnetic quantities:
Nyatakan definisi, simbol dan unit untuk kuantiti-kuantiti magnet berikut:

i. Flux density / *Ketumpatan fluks magnet*

[2.5 marks]
[*2.5 markah*]

ii. Reluctance / *Engganan*

[2.5 marks]
[*2.5 markah*]

CLO1
C2

(b) With the aid of a diagram, explain electromagnet (temporary magnet).
Dengan berbantukan gambarajah, terangkan mengenai elektromagnet (magnet sementara).

[6 marks]
[*6 markah*]

CLO1
C3

(c) A ring shaped iron care has a circumference length of 150mm and a 50mm^2 of cross sectional area. It is wounded with 500 turns of coil. Through measurement, the flux produced in the iron core is 0.2 mWb when 10 mA of current flows through the wound. Interpret the following :
Sebuah teras keluli berbentuk cincin mempunyai nilai ukur lilit 150mm dan luas keratan rentas 50mm^2 . Teras dililit dengan gegelung sebanyak 500 lilitan. Melalui pengukuran, didapati fluks magnet yang terhasil didalam teras adalah 0.2 mWb apabila 10 mA arus melaluinya. Tafsirkan yang berikut :

i. Illustrate the complete magnetic circuit
Gambarkan litar magnet yang lengkap

[2 marks]
[*2 markah*]

ii. Magnetic flux density, B
Ketumpatan fluks magnet, B

[3 marks]
[*3 markah*]

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

[3 marks]
[*3 markah*]

iv. Absolute permeability of the iron core, μ
Ketelapan mutlak teras keluli, μ

[3 marks]
[*3 markah*]

v. Relative permeability, μr
Ketelapan relatif, μr

[3 marks]
[*3markah*]

QUESTION 4
SOALAN 4

CLO1 C1 (a) Define and draw the symbol of a step up and a step down transformers
Takrif dan lukiskan simbol pengubah langkah naik dan pengubah langkah turun

[5 marks]
[*5 markah*]

CLO1 C3 (b) 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, kirakan :

i. The Primary current, Ip
Arus primer, Ip

[2 marks]
[*2 markah*]

ii. The Secondary current, Is
Arus sekunder, Is

[2 marks]
[*2 markah*]

iii. Power losses
Kehilangan kuasa

[3 marks]
[*3 markah*]

iv. Output power
Kuasa keluaran

[2 marks]
[2 *markah*]

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

[3 marks]
[3 *markah*]

CLO1
C2

(c) Identify **TWO (2)** basic parts of AC Machine structure and sketch the respective parts.
*Kenalpasti **DUA (2)** bahagian binaan asas mesin arus ulang alik (AU) dan lakarkan setiap satu bahagian tersebut.*

[8 marks]
[*8 markah*]

SOALAN TAMAT

POLITEKNIK
Jabatan Pengajian Politeknik

DJJ2022- ELECTRICAL TECHNOLOGY

INTRODUCTION TO ELECTRICAL CIRCUITS

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

$P = IV$ $\quad E = Pt$

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

KIRCHOFF'S LAW

$V_1 = V_1 + V_2 + V_3$

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

$I_1 = I_2 + I_3$

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

AC MACHINES

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

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

$E = 2.22 K_d K_p f \phi Z$

TRANSFORMER

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

$E_2 = 4.44 f N_2 \Phi_m$

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

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

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

$B = \mu H$

$\mu = \mu_o \mu_r$

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