SULIT

POLITEKNIK MALAYSIA

BAHAGIAN PEPERIKSAAN DAN PENILAIAN
JABATAN PENDIDIKAN POLITEKNIK
KEMENTERIAN PENDIDIKAN TINGGI

JABATAN KEJURUTERAAN MEKANIKAL

PEPERIKSAAN AKHIR

SESI DISEMBER 2017

DJJ2022 : ELECTRICAL TEHNOLOGY

TARIKH : 07 APRIL 2018
MASA : 8.30 PAGI – 10.30 PAGI (2 JAM)

Kertas ini mengandungi **LAPAN (8)** 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 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) List **FOUR (4)** factors that influence the value of resistance and describe any **TWO (2)** of the factors listed.

*Senaraikan **EMPAT (4)** faktor yang mempengaruhi nilai rintangan dan jelaskan mana-mana **DUA (2)** faktor yang disenaraikan.*

[6 marks]

[*6 markah*]

CLO1
C2

(b) Referring to **Figure 1(b)**, calculate :

*Merujuk kepada **Rajah 1(b)**, kirakan :*

i. The current drawn from the source

Jumlah arus diambil daripada sumber

[4 marks]

[*4 markah*]

ii. The voltage across each resistor

Voltan merentasi setiap perintang

[3 marks]

[*3 markah*]

iii. The power dissipated by the 5 Ω resistor

Kuasa yang dilesapkan oleh perintang 5 Ω

[3 marks]

[*3 markah*]

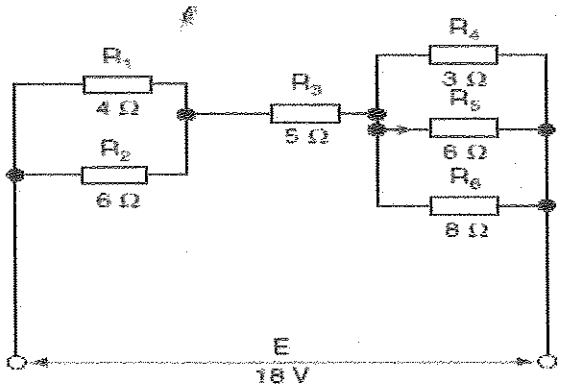

Figure 1(b) / *Rajah 1(b)*

(c) Referring to the circuit shown in **Figure 1(c)**, use Kirchhoff's Law to calculate:
*Berpandukan litar yang ditunjukkan dalam **Rajah 1(c)**, dengan menggunakan Hukum Kirchhoff kirakan :*

CLO1
C3

i. The current flowing in each branch of the circuit
Arus yang mengalir di setiap cawangan litar

[7 marks]
[*7 markah*]

ii. The voltage across the 5Ω resistor.
Voltan merentasi perintang 5Ω

[2 marks]
[*2 markah*]

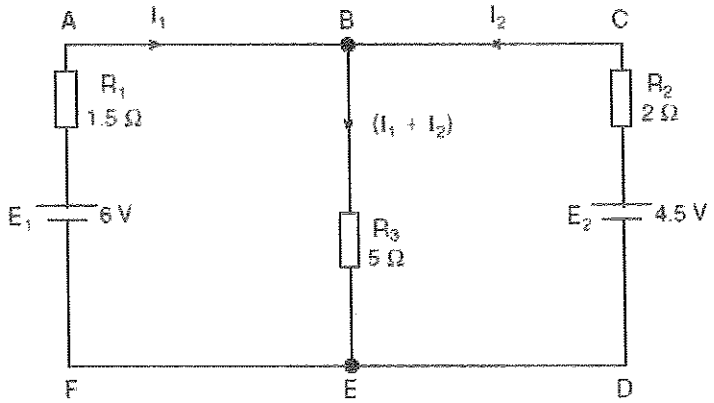

Figure 1(c) / *Rajah 1(c)*

QUESTION 2

SOALAN 2

CLO1
C1

(a) List **FIVE (5)** common types of capacitors used in the industries.
*Senarai **LIMA (5)** jenis pemuat yang biasa digunakan di industri.*

[5 marks]
[*5 markah*]

CLO1
C2

(b) Express the correct circuit diagram and calculate the total inductance of three inductors of 0.08H, 400mH and 400μH which are connected in:
Zahirkan rajah litar yang betul dan kirakan jumlah kearuhan bagi tiga peraruh 0.08H, 400mH dan 400μH yang disambung secara:

i. Series / *Sesiri*

[4 marks]
[*4 markah*]

ii. Parallel / *Selari*

[4 marks]
[*4 markah*]

CLO1
C3

(c) The RL circuit is the combination between resistor and inductor in series. A resistor of 30Ω and inductor of 0.1H are connected with 500V, 50Hz AC supply. Calculate :
Litar RL adalah gabungan antara perintang dan peraruh yang disambung secara sesiri. Perintang dengan nilai rintangan 30Ω dan perauh dengan keraruhan 0.1H disambungkan dengan bekalan AC 500V, 50Hz. Kirakan:

i. Impedance, Z / *Galangan, Z*

[5 marks]
[*5 markah*]

ii. Current flown in the circuit, I / *Arus yang mengalir di dalam litar, I*

[3 marks]
[3 *markah*]

iii. Phase angle, θ / *Sudut fasa,* θ

[2 marks]
[*2 markah*]

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

[2 marks]
[*2 markah*]

QUESTION 3

SOALAN 3

CLO 1
C1

(a) Define Lenz's Law with the aid of a suitable diagram.
Takrifkan Hukum Lenz dengan bantuan rajah yang bersesuaian.

[5 marks]
[*5 markah*]

CLO 1
C2

(b) Explain the principle of electromagnetic induction with reference to **Figure 3(b).**
Terangkan prinsip aruhan electromagnet berpandukan kepada ***Rajah 3(b).***

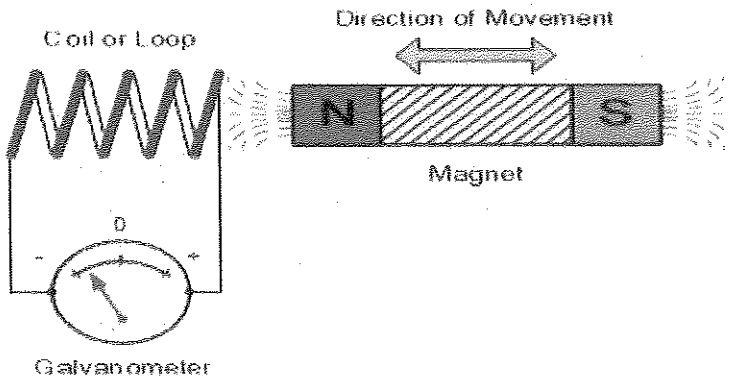

Figure 3(b) / *Rajah 3(b)*

[6 marks]
[*6 markah*]

CLO 1
C3

(c) A core of stainless steel of 100cm length and cross section area 5cm² is wounded with 1500 turns of coil and 5A current flowing through it. The value of μ_r is 1200, calculate:

Teras keluli tahan karat mempunyai panjang 100cm dan luas permukaan 5cm² dengan 1500 lilitan dan arus sebanyak 5A mengalir melaluinya. Nilai μ_r adalah 1200, kirakan :

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

[3 marks]
[*3 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

CLO 1
C1

(a) State **THREE (3)** types of transformer losses and describe any **TWO (2)** of the types listed.
*Nyatakan **TIGA (3)** jenis kehilangan pengubah dan terangkan mana-mana **DUA (2)** jenis yang disenaraikan.*

[5 marks]
[*5 markah*]

CLO 1
C3

(b) A single phase transformer has a voltage ratio of 6:1 and high voltage winding is supplied at 540 V. The secondary winding provides a full load current of 30 A at a power factor of 0.8 lagging. Neglecting losses, determine:
Pengubah fasa tunggal mempunyai nisbah voltan 6 : 1 dan penggulungan voltan tinggi dibekalkan pada 540 V. Penggulungan sekunder menyediakan arus beban penuh 30 A pada faktor kuasa 0.8 kebelakang. Abaikan kehilangan, tentukan:

i. The secondary voltage, V_s
Voltan sekunder, V_s

[4 marks]
[4 *markah*]

ii. The power supplied to load, P_s
Kuasa yang dibekalkan pada beban, P_s

[4 marks]
[4 *markah*]

iii. The primary current, I_p
Arus primer, I_p

[4 marks]
[4 *markah*]

CLO 1
C2

(c) The frequency of the supply to the stator of 8-poles induction motor is 50 Hz and the rotor frequency is 3 Hz. Determine:

Frekuensi bekalan kepada pemegun motor aruhan 8-kutub adalah 50 Hz dan frekuensi pemutar adalah 3 Hz. Tentukan:

i. Synchronous Speed, N_s

Kelajuan segerak, N_s

[2 marks]

[2 *markah*]

ii. Percentage of Slip, % S

Peratusan Slip, % S

[3 marks]

[*3markah*]

iii. Rotor Speed, N_r

Kelajuan rotor, N_r

[3 marks]

[3 *markah*]

SOALAN TAMAT

POLITEKNIK
Jabatan Pengajian Politeknik

DJJ2022- ELECTRICAL TECHNOLOGY

INTRODUCTION TO ELECTRICAL CIRCUITS

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

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

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

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

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

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

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

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

$B = \mu H$

$\mu = \mu_o \mu_r$

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