(8)

SULIT

POLITEKNIK MALAYSIA

BAHAGIAN PEPERIKSAAN DAN PENILAIAN
JABATAN PENDIDIKAN POLITEKNIK
KEMENTERIAN PENDIDIKAN TINGGI

JABATAN KEJURUTERAAN MEKANIKAL

PEPERIKSAAN AKHIR

SESI JUN 2017

DJJ2022 : ELECTRICAL TECHNOLOGY

TARIKH : 02 NOVEMBER 2017
MASA : 8.30 PAGI - 10.30 PAGI (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 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) Give the definition, symbol and unit for electrical quantities below :
Berikan definisi, simbol dan unit untuk kuantiti elektrik di bawah :

i. Voltage
Voltan

[2 marks]
[2 *markah*]

ii. Resistivity
Kerintangan

[2 marks]
[2 *markah*]

iii. Current
Arus

[2 marks]
[2 *markah*]

CLO1
C2

(b) Describe Ohm's Law and sketch a graph to show the relationship between voltage and current if the resistance is constant.
Terangkan Hukum Ohm dan lakarkan satu graf untuk menunjukkan hubungan voltan dan arus jika rintangan adalah tetap.

[7 marks]
[7 *markah*]

CLO1
C4

(c)

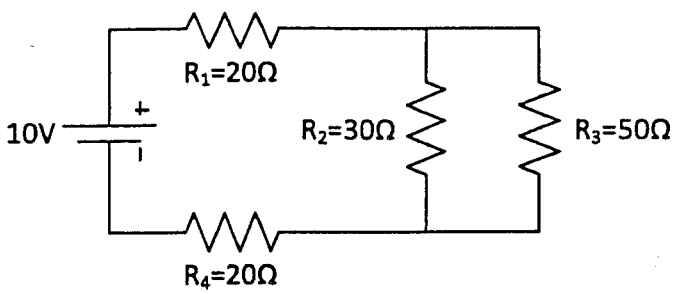

Figure 1

Rajah 1

Simplify the combination circuit in Figure 1 above to identify the following values:

Permudahkan litar gabungan dalam Rajah 1di atas untuk kenalpasti nilai-nilai berikut:

i. The total resistance (R_T) in the circuit,
Jumlah rintangan (R_T) di dalam litar [5 marks]
[5 *markah*]

ii. The total current (I_T) in the circuit
Jumlah arus di dalam litar [2 marks]
[2 *markah*]

iii. Current flows in each resistor R_1 and R_4
Arus yang mengalir melalui R_1 dan R_4 [1 mark]
[1 *markah*]

iv. Voltage drop across resistor R_2
Kejatuhan voltan pada perintang R_2 [4 marks]
[4 *markah*]

QUESTION 2
SOALAN 2

CLO1
C1

(a) Draw and label a three phase (3Φ) sinusoidal waveform.
Lukis dan labelkan gelombang sinus 3 fasa (3Φ)

[6 marks]
[*6 markah*]

CLO1
C2

(b) Based on the Figure 2b, determine the total inductance and capacitance for the given circuit.
Berdasarkan gambar Rajah 2b di bawah, tentukan jumlah kearuhan dan kemuatan untuk litar yang diberi.

i.

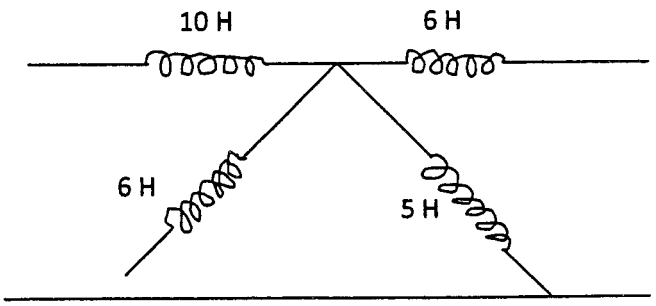

Figure 2(b)(i) / *Rajah 2(b)(i)*

[5 marks]
[*5 markah*]

ii.

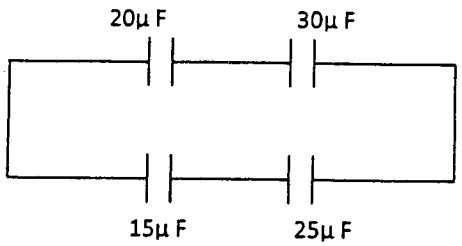

Figure 2(b)(ii) / *Rajah 2(b)(ii)*

[5 marks]
[*5 markah*]

CLO1
C3

(c) Referring to the Figure 3 below , calculate :
Merujuk kepada Rajah 3, kirakan:

i. The total capacitance for the circuit C_T
Jumlah kemuatan di dalam litar, C_T

[3 marks]
[3 *markah*]

ii. The charge for each capacitor Q_1, Q_2 and Q_3
Cas untuk setiap pemuat. Q_1, Q_2 and Q_3

[6 marks]
[6 *markah*]

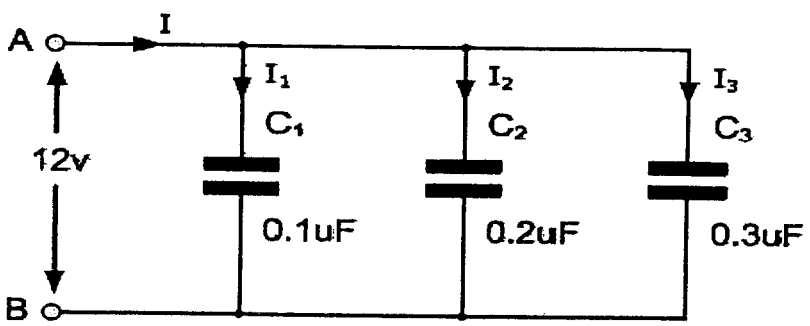

Figure 3/ *Rajah 3*

QUESTION 3

SOALAN 3

CLO1 C1

(a) Define Faraday's Law and list **TWO (2)** methods that can produce emf induction.
*Takrifkan Faraday's Law dan senaraikan **DUA (2)** cara untuk menghasilkan dge teraruh.*

[5 marks]
[*5 markah*]

CLO1 C2

(b) Identify **THREE (3)** factors that influence the electromagnetic strength and explain any **TWO (2)** listed.
*Kenalpasti **TIGA (3)** faktor yang mempengaruhi kekuatan electromagnet dan terangkan **DUA (2)** daripadanya.*

[7 marks]
[*7 markah*]

CLO1 C3

c) A 250mm long round iron core has a $110mm^2$ cross sectional area. It is wounded with 2000 turns of conductor. When measured, the flux produced in the iron core is 0.2mWb when 65mA of current flows through the wound. Calculate:
Sebuah teras besi bulat dengan panjang 250mm mempunyai luas keratan renta sebanyak $110mm^2$. Teras besi dililit dengan 2000 lilitan pengalir. Apabila diukur, nilai fluks yang terhasil di dalam teras besi adalah 0.2mWb apabila 65mA arus mengalir melaluinya. Kirakan :

i. Magnetic flux density, B
Ketumpatan flux magnet, B

[3 marks]
[*3 markah*]

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

[3 marks]
[*3 markah*]

iii. Iron core permeability, μ
Ketelapan sebenar teras besi, μ

[3 marks]
[*3 markah*]

iv. Relative permeability, μ_r
Ketelapan relatif, μ_r

[4 marks]
[*4 markah*]

QUESTION 4

SOALAN 4

CLO1 C1 (a) Define autotransformer and give **FOUR (4)** advantages of autotransformer.
*Takrifkan pengubah automatik dan berikan **EMPAT (4)** kelebihan pengubah automatik tersebut.*

[4 marks]
[4 *markah*]

CLO1 C3 (b) A 2000V/200V, 20 kVA transformer has 66 turns in the secondary coil. Calculate :
Pengubah 2000V/200V, 20kVA mempunyai 66 lilitan pada gegelung sekunder. Kirakan:

i. Primary turns
Bilangan lilitan pada gegelung primer [3 marks]
[3 *markah*]

ii. Primary and secondary currents
Arus pada gegelung primer dan sekunder [4 marks]
[4 *markah*]

iii. Ratio of the transformer
Nisbah pengubah [2 marks]
[2 *markah*]

iv. Determine the type of transformer
Tentukan jenis pengubah [1 marks]
[1 *markah*]

CLO1
C2

(c) The frequency of the supply to the stator of 8-poles induction motor is 50Hz and the rotor frequency is 3 Hz. Determine :
Sebuah motor pearuh 8 kutub mempunyai frekuensi 50 Hz dan frekuensi rotor bernilai 3 Hz. Tentukan :

i. Synchronous speed
Kelajuan segerak

[3 marks]
[3 *markah*]

ii. Percent of slip
Peratus gelinciran

[4 marks]
[4 *markah*]

iii. Rotor speed
Kelajuan rotor

[4 marks]
[4 *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

$V_J = V_1 + V_2 + V_3$

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

$I_1 = I_2 + I_3$

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

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

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

$B = \mu H$

$\mu = \mu_o \mu_r$

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