SULIT

POLITEKNIK MALAYSIA

BAHAGIAN PEPERIKSAAN DAN PENILAIAN
JABATAN PENDIDIKAN POLITEKNIK
KEMENTERIAN PENDIDIKAN TINGGI

JABATAN KEJURUTERAAN MEKANIKAL

PEPERIKSAAN AKHIR

SESI JUN 2015

DJJ2022 : ELECTRICAL TECHNOLOGY

TARIKH : 27 OKTOBER 2015
MASA : 8.30 AM - 10.30 AM (2 JAM)

Kertas ini mengandungi **TUJUH (7)** halaman bercetak.
Soalan Struktur (4 soalan). Jawab semua soalan.
Dokumen sokongan yang disertakan : Rumus

JANGAN BUKA KERTAS SOALAN INI SEHINGGA DIARAHKAN

(CLO yang tertera hanya sebagai rujukan)

INSTRUCTION:

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

ARAHAN :

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

QUESTION 1

SOALAN 1

CLO1 C1

a) State the definition of the electrical quantities below:

Nyatakan definisi untuk istilah elektrik di bawah:

i. Different potential

Beza upaya

ii. Current

Arus

[5 marks]

[*5 markah*]

CLO1 C2

b) Given that $R_1 = 2k\Omega$ and $R_2 = 0.6k\Omega$. Both resister are connected in parallel and supplied with 30V dc. Calculate these values:

Diberi nilai $R_1 = 2k\Omega$ dan $R_2 = 0.6k\Omega$. Kedua-dua perintang disambung secara selari dan dibekalkan dengan 30V DC. Kirakan nilai:

i. The total resistance of the circuit

Jumlah rintangan dalam litar

ii. The total current of the circuit

Jumlah arus dalam litar

iii. The voltage drop at R_2

Voltan susut pada R_2

iv. Current flow through R_1 by using current division method

Arus mengalir melalui R_1 dengan menggunakan kaedah pembahagian arus

[8 marks]

[*8 markah*]

CLO1
C3

c) Based on Figure 1, determine the current I_1, I_2 and I_3 flows in the circuit by using Kirchhoff's Law and all the information given as labeled in the circuit.
Dengan merujuk kepada Rajah 1 di bawah, cari nilai arus I_1, I_2 and I_3 yang mengalir di dalam litar dengan menggunakan Hukum Kirchoff dengan menggunakan maklumat yang dilabel di dalam litar tersebut.

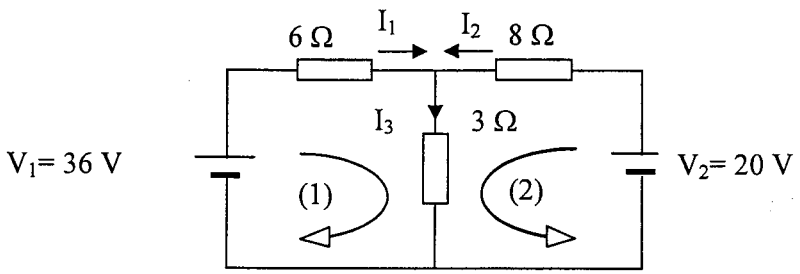

Figure 1
Rajah 1

[12 marks]
[*12 markah*]

QUESTION 2
SOALAN 2

CLO1
C1

a) Describe Self Inductance with a diagram.
Huraikan Aruhan Diri dengan gambarajah.

[4 marks]
[*4 markah*]

CLO1
C2

b) Differentiate between three phase system and single phase system in term of:
Bezakan sistem tiga fasa dan sistem satu fasa :

i. Connection
Sambungan

i. Sinusoidal waveform
Bentuk gelombang

[6 marks]
[*6 markah*]

CLO1
C3

c) A series RLC circuit with resistance 50Ω, inductance 150 mH and capacitance 100μF connected to a 100V, 50Hz AC supply. Calculate :
Sebuah litar sesiri RLC berintangan 50Ω, berkearuhan 150 mH dan berkemuatan 100μF disambung ke bekalan kuasa 100V, 50Hz. Kirakan:

i. Impedance, Z
Galangan ,Z

ii. Current, I
Arus, I

iii. Power factor, cos θ
Faktor kuasa, cos θ

iv. Active power, P
Kuasa aktif, P

[15 marks]
[*15 markah*]

QUESTION 3
SOALAN 3

CLO1 C2

a) i. Explain **THREE (3)** factors affecting the electromagnetic strength.
*Terangkan **TIGA(3)** faktor mempengaruhi kekuatan elektromagnet.*

[6 marks]
[*6 markah*]

CLO1 C2

ii. Illustrate the magnetic field when two current-carrying conductors are put nearby:
Lukiskan medan magnet yang terbentuk apabila dua pengalir pembawa arus diletakkan berdekatan:

a. Has current flow in the same direction in the two conductors.
Arus mengalir pada arah yang sama pada kedua-dua pengalir.
b. Has current flow in the opposite direction in the two conductors.
Arus mengalir pada arah yang berlawanan pada kedua-dua pengalir.

[6 marks]
[*6 markah*]

CLO1 C3

b) A core of mild steel with loop shape has long average of 40cm and cross sectional area $2cm^2$. The steel is wound with 1000 turns of coil and 4A current flowing through it. If given relative permeability is 1200.
Determine these values :
Sebatang teras keluli berbentuk gelang mempunyai panjang 40cm dan luas keratan rentas $2cm^2$. Keluli tersebut dililit dengan 1000 lilitan dan arus 4A mengalir melaluinya. Jika nilai ketelapan relatif adalah 1200. Tentukan nilai :

i. Magneto motive force, F_m
Daya magnet, F_m

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

iii. Absolute permeability, μ
Ketelapan sebenar, μ

iv. Flux density, B
Ketumpatan medan magnet, B

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

vi. The reluctance, S
Engganan, S

[13 marks]
[*13 markah*]

QUESTION 4

SOALAN 4

CLO1 C1

a) List **TWO (2)** types of transformer by referring to its design and state the usage for each type.

*Senaraikan **DUA(2)** jenis pengubah dengan merujuk kepada binaan pengubah dan berikan contoh bagi setiap jenis.*

[6 marks]

[*6 markah*]

CLO1 C2

b) The stator of a 3-phase, 4 pole induction motor is connected to a 50 Hz supply. The rotor runs at 1455 rev/min at full load. Determine:

Stator motor aruhan 3- fasa , 4 kutub disambungkan kepada bekalan 50 Hz. sedang bergerak pada kelajuan 1455 putaran / min pada beban penuh. Tentukan:

i. the synchronous speed
kelajuan segerak

ii. the slip at full load
slip pada beban penuh

[6 marks]

[*6 markah*]

CLO1 C3

c) A 100 kVA, 4000 V/200 V, 50 Hz single phase transformer has 100 secondary turns. Determine :

Sebuah transformer satu fasa 100 kVA, 4000 V/200 V, 50 Hz mempunyai lilitan sekunder 100 lilit. Kirakan:

i. the primary and secondary current
Arus primer dan arus sekunder

ii. the number of primary turns
Bilangan lilitan primer

iii. the maximum value of the flux
Nilai maksimum fluks

[13 marks]

[*13 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

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

PARALLEL

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

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

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

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

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

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

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

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

$B = \mu H$

$\mu = \mu_o \mu_r$

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