SULIT

POLITEKNIK MALAYSIA

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

JABATAN KEJURUTERAAN MEKANIKAL

PEPERIKSAAN AKHIR

SESI DISEMBER 2018

DJJ2022: ELECTRICAL TECHNOLOGY

TARIKH : 20 APRIL 2019
MASA : 8.30 PAGI - 10.30 PAGI (2 JAM)

Kertas ini mengandungi **SEPULUH (10)** halaman bercetak
Struktur (4 soalan)
Dokumen sokongan yang disertakan : Formula

JANGAN BUKA KERTAS SOALAN INI SEHINGGA DIARAHKAN

(CLO yang tertera hanya sebagai rujukan)

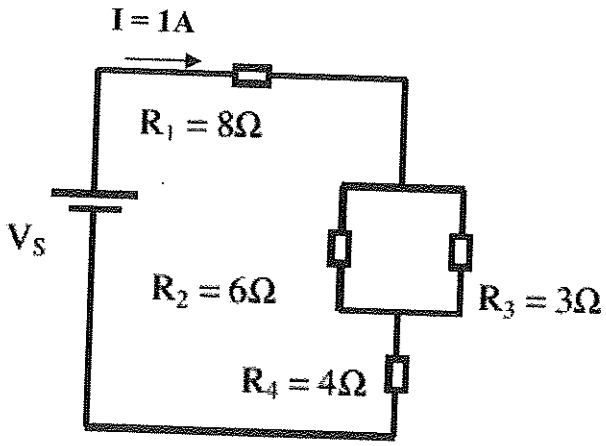

Figure 1(c) / *Rajah 1 (c)*

CLO1
C3

c) Referring to combination circuit in **Figure 1(c) :**
*Merujuk kepada litar gabungan dalam **Rajah 1(c):***

i. Intrepret $P = I^2R$ using Ohm's law
Menggunakan Hukum Ohm buktikan $P = I^2R$

[2 marks]
[2 *markah*]

ii. Calculate total power, P_T
Kira Jumlah Kuasa, P_T

[5 marks]
[5 *markah*]

iii. Calculate voltage drop at R_4 resistor
Kira voltan susut pada perintang R_4

[2 marks]
[2 *markah*]

INSTRUCTION:

This section consists of **FOUR (4)** structured questions. Answer all question

ARAHAN:

*Bahagian ini mengandungi **EMPAT (4)** soalan berstruktur. Jawab semua soalan.*

QUESTION 1

SOALAN 1

CLO1
C1

a) Describe the electrical quantities below
Huraikan kuantiti elektrik di bawah

i. Current / *Arus*

[2 marks]
[2 *markah*]

ii. Electrical Charge / *Cas elektrik*

[2 marks]
[2 *markah*]

iii. Resistance / *Rintangan*

[2 marks]
[2 *markah*]

CLO1
C2

b) The copper wire has a length of 10km and a diameter of 30mm if the power supply is 240V. The resistivity of the wire is 0.48μΩm. Calculate:
Wayar kuprum mempunyai panjang 10 km dan berdiameter 30mm jika bekalan kuasa 240V. Kerintangan wayar adalah 0.48μΩm. Kirakan:

i. The current through copper wire, I
Arus yang melalui wayar kuprum, I

[8 marks]
[8 *markah*]

ii. The power used, P
Kuasa yang digunakan, P

[2marks]
[2 *markah*]

QUESTION 2

SOALAN 2

CLO1
C1

a) List **FIVE (5)** effects of capacitor as an electrical component in a circuit.
*Tuliskan **LIMA (5)** kesan kapasitor sebagai komponen elektrik di dalam litar.*

[5 marks]
[5 *markah*]

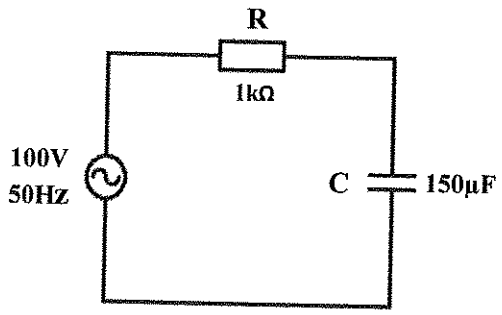

Figure 2 (a) / *Rajah 2 (a)*

CLO1
C2

b) Referring to series RC circuit in **Figure 2(a)**, determine:
*Merujuk kepada litar sesiri RC dalam **Rajah 2(a)**, tentukan:*

i. Capacitive reactance, Xc
Regangan berkemuatan, Xc

[2 marks]
[2 *markah*]

ii. Impedance, Z
Galangan, Z

[2 marks]
[2 *markah*]

iii. Current flow in the circuit, I
Arus yang mengalir di dalam litar, I

[2 marks]
[2 *markah*]

iv. Power factor, P_f
Factor kuasa, P_f

[2 marks]
[2 *markah*]

CLO1
C3

c) A resistor, inductor and capacitor are connected in series with the value of 50Ω, 100mH and 100μF respectively. Given 50VAC supply voltage and 1kHz frequency. Calculate:
Sebuah perintang, peraruh dan pemuat disambungkan secara sesiri dengan nilai 50Ω, 100mH dan 100μF masing-masing. Diberikan voltan bekalan 50VAU dan frekuensi 1kHz. Kirakan:

i. Impedance, Z
Galangan, Z

[6 marks]
[6 *markah*]

ii. Total current in the circuit, I_T
Jumlah arus mengalir dalam litar, I_T

[2 marks]
[2 *markah*]

iii. Phase Angle, Θ
Sudut fasa, Θ

[2 marks]
[2 *markah*]

iv. Power factor, Pf
Factor kuasa, Pf

[2 marks]
[2 *markah*]

QUESTION 3

SOALAN 3

CLO1
C1

a) Describe the electromagnetic effect with the aid of a suitable diagram when using **TWO (2)** conductors.
*Terangkan kesan medan magnet berserta rajah yang bersesuaian apabila menggunakan **DUA (2)** konduktor.*

[5 marks]
[5 *markah*]

CLO1
C2

b) A mild steel ring has a diameter of 18cm and a cross sectional area of $5cm^2$. If the relative permeability is 1250, calculate:
Sebuah keluli lembut berbentuk cincin mempunyai diameter 18cm dan luas keratan rentas $5cm^2$. Jika ketelapan bandingan diberi sebanyak 1250, kirakan:

i. The reluctance of the mild steel, S
Nilai engganan keluli lembut tersebut, S

[4 marks]
[4 *markah*]

ii. The magnetomotive force (mmf) required to produce a flux of 600μWb
Kirakan daya medan magnet (mmf) yang diperlukan untuk menghasilkan fluks 600μWb

[2 marks]
[2 *markah*]

iii. Absolute permeability, μ_a
Ketelapan mutlak, μ_a

[2 marks]
[2 *markah*]

CLO1
C3

c) i. An iron ring has a cross sectional area of 300mm^2 and a diameter of 15cm. The circumference value given is 500 turns. If the value of relative permeability is 200, calculate the magnetic field strength in the ring. The coil resistance is 374Ω and the voltage supply is 240V.

Satu cincin besi mempunyai keluasan keratan rentas 300mm^2 dan diameter 15cm. Diberi nilai lilitan adalah 500 lilitan. Jika nilai kebolehtelapan bandingan ialah 200, kirakan kekuatan medan magnet dalam cincin. Rintangan gegelung ialah 374Ω dan bekalan voltan ialah 240V.

[6 marks]
[6 *markah*]

ii. A mild steel ring has a radius of 60mm and a cross-sectional area of 500mm^2. A 0.5A of current flows in a coil wound around the ring and the flux produced is 0.1mWb. If the relative permeability is 250, calculate:

Sebuah gelang keluli lembut mempunyai jejari 60mm dan luas keratan rentas 500mm^2. Arus 0.5A mengalir melalui gelung yang terlilit pada gelang keluli lembut tersebut dan fluks yang terhasil ialah 0.1mWb. Jika ketelapan bandingan ialah 250, kirakan:

a) Flux density, B
Ketumpatan fluks, B

[2 marks]
[2 *markah*]

b) Reluctance of the mild steel. S
Engganan bagi keluli lembut, S

[4 marks]
[4 *markah*]

QUESTION 4
SOALAN 4

CLO1
C1

a) Describe **TWO (2)** types of transformer lossess
*Terangkan **DUA (2)** jenis kehilangan dalam pengubah.*

[5 marks]
[5 *markah*]

CLO1
C3

b) A 100 kVA, 4000 V/ 200 V, 50Hz single phase transformer has 100 secondary turns. Determine:
Sebuah pengubah satu fasa 100 kVA, 4000 V/ 200 V, 50Hz mempunyai lilitan sekunder sebanyak 100 lilitan. Tentukan:

i. The primary and secondary current, I_P & I_S
Arus primer dan arus sekunder, I_P & I_S

[6 marks]
[6 *markah*]

ii. The number of primary turns, N_P
Bilangan lilitan primer, N_P

[3 marks]
[3 *markah*]

iii. The maximum value of flux, Ø
Nilai maksimum fluks, Ø

[3 marks]
[3 *markah*]

CLO1
C2

c) A 5 pole, 300 V, 50 Hz alternating current (AC) generator runs in a speed of 750 rpm has 4 slots and 15 conductors/slot. If the useful flux is 15mWb, calculate:

Sebuah penjana AC 5 kutub, 300 V, 50 Hz bergerak dengan kelajuan sebanyak 750rpm, 4 slot dan mempunyai 15 konduktor/slot. Diberi nilai flux yang digunakan adalah 15mWb, kirakan:

i. Total number of conductor in the generator, Z
Jumlah konduktor dalam penjana, Z

[2marks]
[2 *markah*]

ii. Percentage slip in full load, %S
Peratus slip dalam keadaan beban penuh, %S

[4 marks]
[4 *markah*]

iii. Rotor frequency, fr
Frekuensi rotor, fr

[2 marks]
[2 *markah*]

SOALAN TAMAT

POLITEKNIK MALAYSIA

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

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

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

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

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

$B = \mu H$

$\mu = \mu_o \mu_r$

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