SULIT

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

JABATAN KEJURUTERAAN MEKANIKAL

PEPERIKSAAN AKHIR

SESI JUN 2019

DJJ2022 : ELECTRICAL TECHNOLOGY

TARIKH : 02 NOVEMBER 2019
MASA : 2.30 PETANG – 4.30 PETANG (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)** structured questions. Answer **ALL** questions.

ARAHAN:

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

QUESTION 1

SOALAN 1

CLO1
C1

(a) Define the following terms and state its formula;

Takrifkan istilah dibawah dan nyatakan formulanya;

i. Ohm's Law

Hukum Ohm

[3 marks]
[*3 markah*]

ii. Electrical Energy

Tenaga Elektrik

[3 marks]
[*3 markah*]

CLO1
C2

(b) Explain **FOUR (4)** factors that affect the value of resistance

*Terangkan **EMPAT (4)** faktor yang mempengaruhi nilai rintangan*

[10 marks]
[*10 markah*]

CLO1
C3

(c) Referring to **Figure 1 (c)**, a 120V source is connected to the circuit. If R_1 = 10Ω, R_2 = 20Ω , R_3 = 15Ω. Calculate :

*Merujuk kepada **Rajah 1 (c)** , punca bekalan 120V disambung ke litar. Jika R_1 = 10Ω, R_2 = 20Ω, R_3 = 15Ω. Kirakan :*

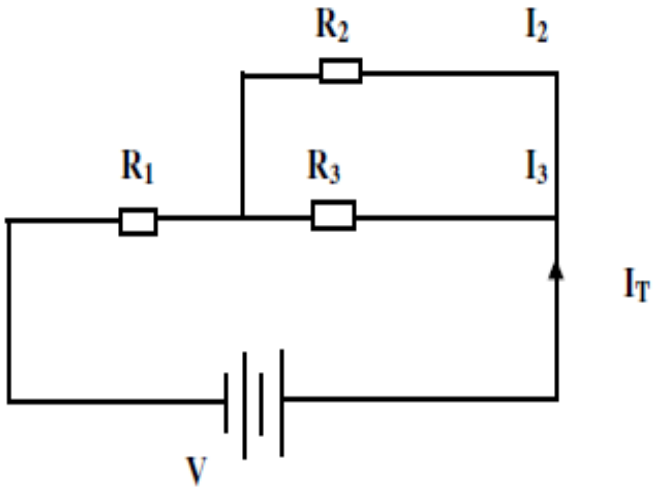

Figure 1 (c) / R*ajah 1 (c)*

i. Total resistance, R_T

Jumlah rintangan, R_T

[3 marks]
[*3 markah*]

ii. Total current, I_T

Jumlah arus, I_T

[3 marks]
[*3 markah*]

iii. Current I_2 and I_3

Arus I_2 dan I_3

[3 marks]
[*3 markah*]

QUESTION 2

SOALAN 2

CLO1
C1

(a) Describe **TWO (2)** types of inductors and it's functions

Terangkan ***DUA (2)*** *jenis peraruh dan fungsinya*

[5 marks]
[*5 markah*]

CLO1
C2

(b) Express the value of total capacitance with the aid of diagram of three capacitors which each of it has 120μF of capacitance connected in:

Nyatakan jumlah kemuatan bagi tiga pemuat *dengan bantuan gambarajah dengan nilai kemuatan bagi setiap pemuat adalah 120μF apabila ia disambung secara:*

i. Series

Siri

[4 marks]
[*4 markah*]

ii. Parallel

Selari

[4 marks]
[*4 markah*]

CLO1
C3

(c) A RL series circuit has 10Ω resistor, 0.2H inductor and is supplied with 250V, 50Hz AC.

*Sebuah litar siri RL mempunyai 10*Ω *perintang, 0.2 H peraruh dan voltan bekalan 250V, 50Hz AC.*

i. Sketch the diagram of the series circuit

Lakarkan gambarajah litar sesiri tersebut

[2 marks]
[*2 markah*]

Calculate :

Kirakan :

ii. lmpedance, Z

Galangan, Z

[4 marks]
[*4 markah*]

iii. Current, I

Arus, I

[3 marks]
[*3 markah*]

iv. Phase angle, Θ

Sudut fasa, Θ

[3 marks]
[*3 markah*]

QUESTION 3

SOALAN 3

CLO1
C1

(a) Identify factors that affect electromagnetic strength

Kenalpasti faktor-faktor yang mempengaruhi kekuatan elektomagnet

[5marks]
[5 *markah*]

CLO1
C2

(b) Interpret and express the unit for each of the terms below :

Huraikan dan nyatakan unit bagi setiap terma dibawah :

i. Magnetiomotive Force, Fm

Daya medan magnet, Fm

[2 marks]
[2 *markah*]

ii. Magnetic Field Strength, H

Kekuatan medan magnet, H

[2 marks]
[2 *markah*]

iii. Magnetic Flux Density, B

Ketumpatan fluks magnet, B

[2 marks]
[2 *markah*]

CLO1
C3

(c) A ring iron core has a mean circumference of 250 mm and a cross sectional area of 110mm^2. It is wound with 2000 turns. Through measurement, the value of fluxs in the iron is 0.2 mWb when 65mA current flows through the winding. Calculate:

Satu teras besi berbentuk gelang yang mempunyai purata ukurlilit sebanyak 250mm dan luas keratan rentas ialah 110mm^2.Teras itu dililit dengan 2000 lilitan pengalir. Melalui pengukuran, didapati 0.2mWb fluks wujud apabila 65mA melalui lilitan tersebut. Kirakan:

Given the permeability of free space, $\mu_0 = 4\pi \times 10^{-7}$ H/m

Diberi nilai ketelapan ruang bebas, $\mu_0 = 4\pi \times 10^{-7}$ H/m

i. Flux density, B

Ketumpatan fluks, B

[3 marks]
[*3 markah*]

ii. Magnetic field strength, H

Kekuatan medan magnet, H

[3 marks]
[*3 markah*]

iii. Absolute permeability, μ_a

Ketelapan mutlak,μ_a

[3 marks]
[*3 markah*]

iv. Relative permeability, μ_r

Ketelapan bandingan, μ_r

[2 marks]
[*2 markah*]

v. Iron core reluctance, S

Engganan teras besi, S

[3 marks]
[*3 markah*]

QUESTION 4

SOALAN 4

CLO1 C1

(a) Describe the operational principle of a transformer with the aid of diagram
Jelaskan prinsip kerja bagi sebuah pengubah dengan bantuan gambarajah

[5 marks]
[*5 markah*]

CLO1 C3

(b) An ideal 25 kVA transformer has 500 turns on the primary winding and 40 turns on the secondary winding. The primary is connected to 3000 V, 50 Hz supply. Calculate :
Sebuah pengubah ideal 25kVA mempunyai 500 lilitan pada bahagian primer dan 40 lilitan pada bahagian sekunder. Bahagian primer disambung kepada 3000V, 50Hz bekalan. Kirakan :

i. Primary and secondary currents on full-load
Arus primer dan sekunder ketika beban penuh

[6 marks]
[*6 markah*]

ii. Secondary voltage
Voltan sekunder

[3 marks]
[*3 markah*]

iii. Maximum core flux
Fluks maksimum teras

[3 marks]
[*3 markah*]

CLO1
C2

(c) Three phase induction motor, 6 poles, 50 Hz is rotating at a speed of 3% slip. Express the value of :

Sebuah motor aruhan 3 fasa, 6 kutub, 50 Hz berputar dengan kelajuan 3% gelincir. Nyatakan nilai untuk :

i. Synchronous speed, Ns

Kelajuan segerak, Ns

[5 marks]
[*5 markah*]

ii. Rotor speed, Nr

Kelajuan rotor, Nr

[3 marks]
[*3 markah*]

SOALAN TAMAT

DJJ 2022 – ELECTRICAL TECHNOLOGY

FORMULA

INTRODUCTION TO ELECTRICAL CIRCUITS

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

$P = IV$ $E = Pt$

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

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

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

AC MACHINES

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

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

$E = 2.22 K_d K_p f \phi Z$

TRANSFORMER

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

$E_2 = 4.44 f N_2 \Phi_m$

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

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

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

$B = \mu H$

$\mu = \mu_o \mu_r$

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