INSTRUCTION:

This section consists of **FOUR (4)** questions. Answer **ALL** questions.

ARAHAN :

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

QUESTION 1

SOALAN 1

CLO1 C1

a) i. State **THREE (3)** factors that affect the resistance of conductor materials.

*Nyata **TIGA (3)** faktor yang mempengaruhi nilai kerintangan sesuatu pengalir.*

[3 marks]
[3 markah]

CLO1 C1

ii. List **TWO (2)** types of the electrical circuits

*Senaraikan **DUA (2)** jenis litar-litar elektrik*

[2 marks]
[2 markah]

CLO2 C2

b) Express the value of resistance through the aluminum wire with a length of 100km and a diameter of 25cm if the supply is 100V. The resistivity of the wire is 25.5μΩm.

Kirakan nilai rintangan melalui wayar aluminium dengan panjang 100km dan diameter 25cm jika bekalan 100V. Kerintangan wayar adalah 25.5μΩm.

[9 marks]
[9 markah]

CLO2 C3

c) Given that R1 = 4kΩ and R2 = 1.2kΩ. Both resistors are connected in parallel and supplied with 40 V dc. Calculate these values:

Diberi nilai R1 = 4kΩ and R2 = 1.2kΩ. Kedua-dua perintang disambung secara selari dan mempunyai nilai voltan 40 V dc. Kirakan nilai:

i. The total resistance (R_T) of the circuit

Jumlah rintangan (R_T) di dalam litar

[4 marks]
[4 markah]

ii. The total current of the circuit
Jumlah arus di dalam litar

[3 marks]
[3 markah]

iii. The voltage drop at R1.
Voltan susut pada perintang R1

[1 marks]
[1 markah]

iv. Current flow through R2 by using current division method.
Arus yang melalui perintang R2 dengan menggunakan kaedah pembahagian semasa.

[3 marks]
[3 markah]

QUESTION 2
SOALAN 2

CLO1
C1

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

[5 marks]
[5 markah]

CLO1
C2

b) Compare the Single Phase System and Three Phase System in terms of definition, connection, waveform and application.
Bandingkan sistem satu fasa dan sistem tiga fasa dari segi definisi, sambungan, bentuk gelombang dan aplikasi.

[8 marks]
[8 markah]

CLO2
C3

c) AC circuit 200V, 50 Hz connected in series with resistance 40Ω, inductance reactance 20Ω and capacitance reactance 12Ω. Calculate:
Litar AC mempunyai 200V, 50Hz disambung secara siri dengan kerintangan 40Ω, regangan kearuhan 20Ω dan regangan kemuatan 12Ω. Kirakan

i. Impedance (Z)
Galangan

[4 marks]
[4 markah]

ii. Current
Arus

[2 marks]
[2 markah]

iii. Phase angle
Sudut fasa

[3 marks]
[3 markah]

iv. Power factor
Faktor kuasa

[3 marks]
[3 *markah*]

QUESTION 3
SOALAN 3

CLO1
C1

a) State the definition, symbol and unit for the following magnetic quantities:
Nyatakan definisi, symbol dan kuantiti bagi kuantiti-kuantiti magnet berikut:

i. Magnetic Flux
Fluks magnet

[2.5 marks]
[2.5 markah]

ii. Reluctance
Keengganan

[2.5 marks]
[2.5 *markah*]

CLO2
C2

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. Express the value of:
Teras keluli lembut dengan bentuk gelung mempunyai purata panjang 40cm dan luas keratan rentas 2cm^2. Keluli itu dililit dengan 1000 lilitan gegelung dan arus 4A mengalir melaluinya. Jika diberi kebolehtelapan relatif ialah 1200. Nyatakan nilai bagi:

i. Magnetomotive force.
Daya gerak magnet.

[2 marks]
[2 markah]

ii. Magnetic field strength, H
Kekuatan medan magnet

[3 marks]
[3 markah]

iii. Flux density, B
Ketumpatan Fluks magnet.

[3 marks]
[3 *markah*]

CLO2
C3

c)A steel bar of 500 mm length, 20 mm width and 60 mm height is wounded with 450 turns wire. Through measurement, a magnetic field strength of 2500 At/m is established within the core that produced 9.5 mWb of magnetic flux. Calculate:
Palang besi dengan panjang 500 mm, lebar 20 mm dan ketinggian 60 mm dililit dengan 450 putaran dawai. Melalui pengukuran, kekuatan medan magnet 2500 At/m ditetapkan dalam teras yang menghasilkan 9.5 mWb urat daya magnet. Kirakan:

i. Flux density.
Ketumpatan Fluks magnet.

[4 marks]
[4 markah]

ii. Magnetomotive force.

Daya gerak magnet.

[2 marks]
[2 markah]

iii. Current flow through the wire.

Arus yang mengalir melalui wayar.

[2 marks]
[2 markah]

iv. Relative permeability of the steel core.

Ketelapan relatif bagi teras besi.

[2 marks]
[2 markah]

v. Reluctance of the magnetic circuit.

Keengganan bagi litar magnet.

[2 marks]
[*2 markah*]

QUESTION 4

SOALAN 4

CLO1
C1

a) Define autotransformers and List **THREE (3)** advantages of Autotransformers
*Definisikan Autotransformer dan senaraikan **TIGA (3)** kelebihan Autotransformer*

[4 marks]
[4 *markah*]

CLO2
C3

b) As an assistant engineer, you are given a task to calculate some quantities of a new machine with built-in transformer. The datasheet from the machine's manual book shows the following data:

Power Consumed: 70kVA

Voltage Input/output: 850 V / 225 V

Frequency: 60 Hz

Number of Input Winding: 800 turns

You are asked to calculate the following quantities:

Sebagai seorang pembantu jurutera, anda diberi tugas untuk menentukan dan mengira beberapa perkara untuk mesin baru yang dilengkapi dengan transformer. Lembaran data daripada buku manual mesin menunjukkan data berikut:

Kuasa yang digunakan: 70kVA

Voltan masukan / keluaran: 850 V / 225 V

Frekuensi: 60 Hz

Bilangan lilitan masukan: 800 turns

Anda disuruh untuk mengira perkara berikut:

i. The number of secondary winding.
Bilangan lilitan pada gegelung sekunder.

[3 marks]
[3 markah]

ii. The primary current
Arus pada gegelung primer

[3 marks]
[3 markah]

iii. The secondary current
Arus pada gegelung sekunder

[3 marks]
[3 markah]

iv. The maximum magnetic flux
Nilai fluks maksima

[3 marks]
[3 *markah*]

CLO2
C2

(c) The frequency of the supply to the stator of 6 poles induction motor is 40 Hz and the rotor frequency is 2 Hz. Express the value of:
Sebuah motor pearuh 6 kutub mempunyai frekuensi 40 Hz dan frekuensi rotor bernilai 2 Hz. Nyatakan nilai bagi:

i. Synchronous speed
Kelajuan segerak

[3 marks]
[3 markah]

ii. Percent of slip
Peratus gelinciran

[4 marks]
[4 markah]

iii. Rotor speed
Kelajuan rotor

[2 marks]
[2 markah]

SOALAN TAMAT

DJJ20053 – ELECTRICAL TECHNOLOGY

FORMULA

INTRODUCTION TO ELECTRICAL CIRCUITS

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

$$P = IV \qquad E = Pt$$

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

KIRCHOFF'S LAW

$V_1 = V_1 + V_2 + V_3$

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

$I_1 = I_2 + I_3$

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

$$I = \frac{V}{Z}$$

$V_L = IX_L \qquad V_R = IR$

$V_C = IX_C$

$$Z = \sqrt{R^2 + (X_L - X_C)^2}$$

$$\theta = \tan^{-1}\left[\frac{X_L - X_C}{R}\right]$$

$$Cos\theta = \frac{R}{Z}$$

AC MACHINES

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

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

$$E = 2.22 K_d K_p f \phi Z$$

TRANSFORMER

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

$$E_2 = 4.44 f N_2 \Phi_m$$

Complex Power, S (VA) = VI

Actual Power,P (W) = $VI \cos\theta$

Reactive Power,Q (VAR) = $VI \sin\theta$

$I = \frac{\text{Power}}{\text{Voltage}}$

Power losses = Core losses + $Ip^2Rp + Is^2Rs$

Output power = Power x power factor

Input power = output power + power losses

Efficiency,%η = $\frac{\text{output power}}{\text{Input power}}$ x 100

ELECTROMAGNET

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

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

$$B = \mu H$$

$$\mu = \mu_o \mu_r$$

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