UNIVERSITI MALAYSIA PERLIS

Peperiksaan Akhir Semester Kedua
Sidang Akademik 2018/2019

Mac 2019

DKT 123 – Teknologi Elektrik
[Electrical Technology]

Masa: 3 Jam

Please make sure that this paper has **ELEVEN (11)** printed pages including this front page before you start the examination.
*[Sila pastikan kertas soalan ini mengandungi **SEBELAS (11)** muka surat yang bercetak termasuk muka hadapan sebelum anda memulakan peperiksaan ini.]*

This question paper contains **TWO (2)** parts:.
*[Kertas soalan ini mengandungi **DUA (2)** bahagian:]*

Part A : This part has **FOUR (4)** questions. Answer all questions (80 marks).
[Bahagian A : *Bahagian ini mengandungi **EMPAT (4)** soalan. Jawab semua soalan (80 markah).]*

Part B : This part has **TWO (2)** questions. Answer any **ONE (1)** question (20 marks).
[Bahagian B : *Bahagian ini mengandungi **DUA (2)** soalan. Jawab mana-mana **SATU(1)** soalan (20 markah).]*

Each question contributes **TWENTY (20)** marks.
*[Setiap soalan menyumbang **DUA PULUH (20)** markah.]*

PART A
[BAHAGIAN A]
Answer all questions
[Jawab semua soalan]

Question 1
[Soalan 1]

(a) State **TWO(2)** advantages of three phase system and explain the condition where the three phase system is said to be in balanced.

*[Senaraikan **DUA(2)** kelebihan sistem tiga fasa dan jelaskan keadaan di mana sistem tiga fasa dikatakan berada dalam keseimbangan.]*

(4 Marks/*Markah*)

(b) A wye-connected balanced three-phase voltage sources is connected to a wye-connected balanced load with an impedance of **(3+j7) Ω** per phase. If $\mathbf{V_{an}=100\angle 45^0 V}$ and the voltages are in positive sequence,

*[Satu sumber seimbang voltan tiga-fasa yang disambung secara wye bersambung dengan beban seimbang sambungan delta dengan galangan **(3 + j7) Ω** per fasa. Jika $V_{an} = 100\angle 45^0$ V dan voltan dalam jujukan positif.]*

i. Draw the diagram of this three-phase system configuration and label its parameter accordingly.
[Lukiskan gambarajah tatarajah sistem tiga-fasa ini dan labelkan parameter dengan sewajarnya.]

(4 Marks/*Markah*)

ii. Calculate the average power per phase P_P and total average power P_T.
[Kira purata kuasa per fasa P_P dan jumlah purata kuasa P_T]

(3 Marks/*Markah*)

iii. Calculate the reactive power per phase Q_P and total reactive power Q_T.
[Kira kuasa regangan per fasa Q_P dan jumlah kuasa regangan Q_T]

(3 Marks/*Markah*)

(c) Evaluate the following circuit in **Figure 1** using mesh analysis to find current I_o.
*[Nilaikan litar dalam **Rajah 1** berikut menggunakan analisis jejaring untuk mencari nilai I_o.]*

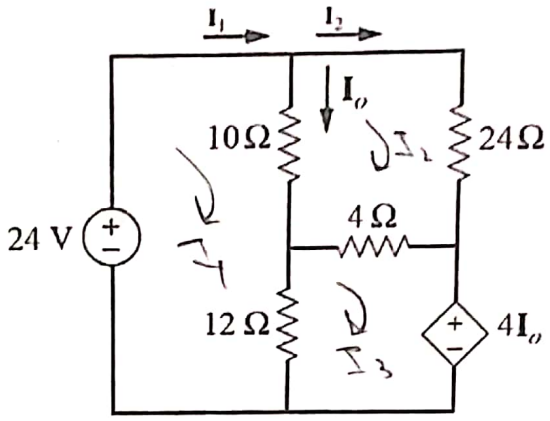

Figure 1
[Rajah 1]

(6 Marks/*Markah*)

Question 2
[Soalan 2]

(a) Coupling coefficient (k) is the measure of magnetic coupling between two coils.
[Pekali gandingan (k) adalah ukuran gandingan magnet antara dua gegelung.]

(i) Define k when the condition as follow:
[Definisikan k apabila keadaan seperti berikut:]

$k > 0.5$

$k < 0.5$

(2 Marks/*Markah*)

(ii) Given the circuit as in **Figure 2**, and k = 1 where
*[Diberi litar seperti **Rajah 2** dan k = 1 di mana]*

$$k = \frac{M}{\sqrt{L_1 L_2}}$$

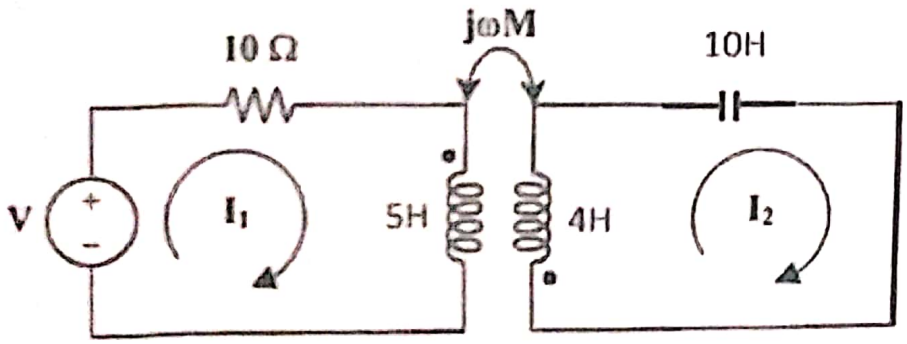

Figure 2
[Rajah 2]

Evaluate the value for phasor current I_1 and I_2 given that
[Hitungkan nilai untuk arus pemfasa I_1 dan I_2 diberi]

$$V = 60 \cos (4t + 30^0)V$$

(6 Marks/ *Markah*)

(b) Dot determination is required to specify the polarity of mutual induced voltage. With appropriate figure, interpret the application of the dot convention.
[Penentuan bintik diperlukan untuk menentukan kekutuban voltan saling teraruh. Dengan gambarajah yang sesuai, tafsirkan penggunaan kelaziman bintik.]

(6 Marks/*Markah*)

(c) Calculate the mesh currents in the circuit shown in **Figure 3**.
*[Hitung arus jejaring dalam litar pada **Rajah 3**.]*

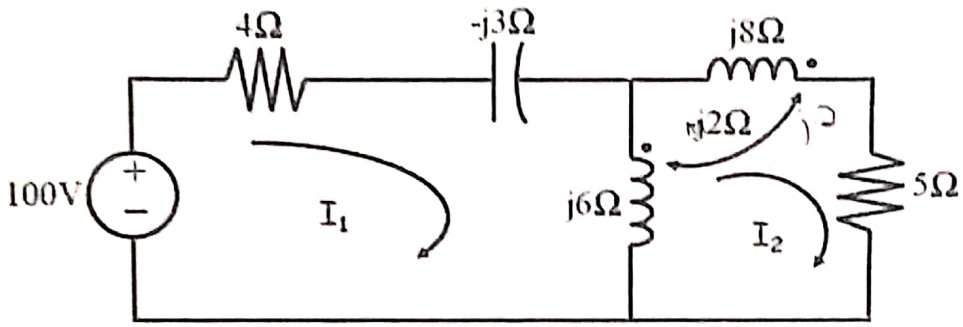

Figure 3
[Rajah 3]

(6 Marks/*Markah*)

Question 3
[Soalan 3]

(a) With the aid of a suitable diagram briefly explain the concept of mutual inductance.
[Dengan bantuan gambarajah yang sesuai terangkan secara ringkas konsep aruhan saling.]

(4 Marks/*Markah*)

(b) Briefly discuss **THREE(3)** differences between an electric circuit and magnetic circuit.
*[Bincangkan secara ringkas **TIGA (3)** perbezaan di antara litar elektrik dan litar magnet.]*

(3 Marks/*Markah*)

(c) If one section of the existing core material is replaced with cast iron whose relative permeability is 166 and flux of 1 mWb flows in the circuit as shown in **Figure 4**, determine the followings:
(Given $\mu_o = 4\pi \times 10^{-7}$)
*[Sekiranya satu bahagian bahan teras sedia ada digantikan dengan besi tuang yang kebolehtelapan relatif 166 dan aliran fluks 1 mWb dalam litar seperti ditunjukkan dalam **Rajah 4**, tentukan yang berikut:*
(Diberi $\mu_o = 4\pi \times 10^{-7}$)]

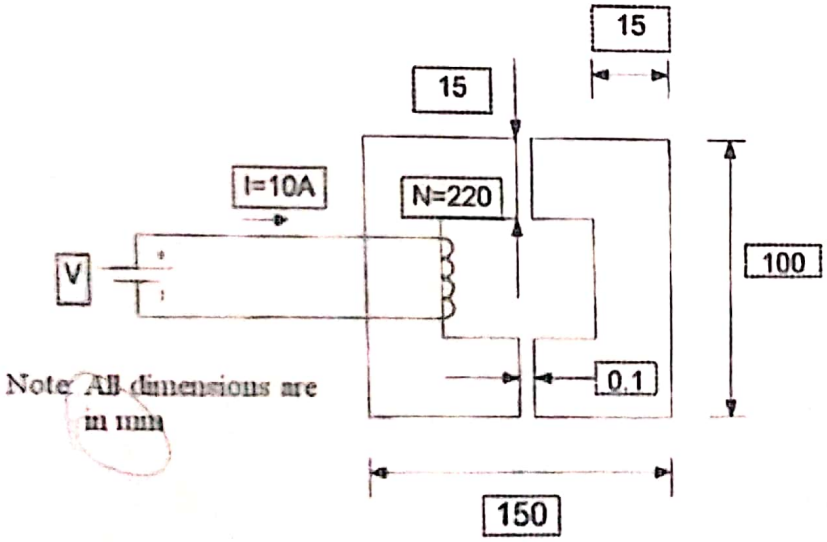

Figure 4
[Rajah 4]

i. the resultants mean length of flux path the each core made by the air gaps.
[Panjang paduan min untuk laluan fluks pada setiap teras yang dihasilkan oleh jurang udara]

(4 Marks/*Markah*)

ii. magnetic flux densities in each core and air gap.
[Ketumpatan fluks magnet dalam setiap teras dan jurang udara.]

(3 Marks/*Markah*)

iii. Magnetic field strength in each core and air gap.
[Kekuatan medan magnet pada setiap teras dan jurang udara.]

(3 Marks/*Markah*)

iv. The reluctances in each core and air gap.
[Engganan pada setiap teras dan jurang udara.]

(3 Marks/*Markah*)

Question 4
[Soalan 4]

(a) Explain the meaning of the device Transformer and state **TWO (2)** types of Transformer.
*[Jelaskan maksud peranti Pengubah dan nyatakan **DUA(2)** jenis Pengubah.]*

(4 Marks/*Markah*)

(b) Power transformer has two types of core. Name both types and explain their differences.
[Pengubah kuasa mempunyai dua jenis teras. Namakan kedua-duanya jenis dan terangkan perbezaannya.]

(4 marks/*Markah*)

(c) Consider an ideal single-phase 2400V-240V transformer. The primary is connected to a 2000V source and the secondary is connected to an impedance of $2\angle 36.9^{\circ}\Omega$, calculate,
[Andaikan sebuah pengubah unggul fasa tunggal 2400V-240V. Yang utama disambungkan ke punca 2000V dan yang kedua disambungkan ke galangan $2\angle 36.9^{\circ}\Omega$, hitung.]

i. the secondary output current and voltage.
[Arus dan voltan keluaran kedua.]

(3 Marks/*Markah*)

ii. the primary input current.
[Arus masukan utama.]

(3 Marks/Markah)

iii. the load impedance as seen from the primary side.
[Galangan beban yang dilihat dari sudut utama.]

(3 Marks/*Markah*)

iv. the input and output apparent power.
[Masukan dan keluaran kuasa ketara.]

(3 Marks/*Markah*)

V = IR
I = V/R

PART B
[BAHAGIAN B]
Answer any ONE (1) question
[Jawab mana-mana SATU (1) soalan]

Question 5
[Soalan 5]

(a) State **FOUR (4)** categories of losses occurring in DC machine.
*[Nyatakan **EMPAT (4)** kategori kehilangan yang berlaku pada mesin DC.*

(4 Marks/ *Markah*)

(b) Permanent magnet, separately excited and self-excited are three types of DC machine. Compare the differences between separately excited and self excited DC machine. Draw the equivalent circuit for both DC machine.
[Magnet kekal, menguja terpisah dan menguja sendiri adalah tiga jenis mesin DC. Bandingkan perbezaan antara mesin DC penguja terpisah dan menguja sendiri. Lukiskan litar setara bagi kedua-dua mesin DC ini]

(6 Marks/*Markah*)

(c) A 240V DC shunt motor draws 12A at 2000rpm. The armature resistance is 0.5Ω and field winding resistance is 450Ω.
[Sebuah motor pirau DC 240V menarik 12A pada 2000rpm. Rintangan angker ialah 0.5Ω dan rintangan medan penggulungan ialah 450Ω]

i. Calculate the value of the torque
[Kira nilai daya kilas]

(5 Marks/*Markah*)

ii. Calculate the speed and line current at a torque of 20 N-m (if field current is constant)
[Kira kelajuan dan arus baris pada 20 N-m daya kilas (jika arus medan adalah malar)]

(5 Marks/*Markah*)

Question 6
[Soalan 6]

(a) State the first and second law of Faraday's Law.
[Nyatakan hukum pertama dan kedua bagi Hukum Faraday.]

(4 Marks/*Markah*)

(b) Elaborate the main part in synchronous machines.
[Perihalkan bahagian utama dalam mesin segerak.]

(6 Marks/*Markah*)

(c) A three-phase, wye-connected 2300 kVA and 6.6 kV generator operates at full-load. The per-phase armature resistance R_a and the synchronous reactance, X_d, are (0.06+j10.5)Ω. Calculate the percent voltage regulation at
[Sebuah tiga fasa dengan sambungan wai 2300 kVA dan 6.6 kV penjana beroperasi pada beban penuh. Rintangan angker per fasa R_a dan regangan segerak X_d ialah (0.06+j10.5)Ω. Kirakan peratus peraturan voltan pada:]

(i) 0.8 power-factor lagging
[0.8 faktor-kuasa susulan]

(5 Marks/*Markah*)

(i) 0.8 power-factor leading.
[0.8 faktor-kuasa mendulu]

(5 Marks/*Markah*)

Appendix 1
[Lampiran 1]

Given some theorem:
[Diberi sebahagian teorem:]

Connection	Phase voltages/currents	Line voltages/currents
Y-Y	$\mathbf{V}_{an} = V_p\angle 0^\circ$	$\mathbf{V}_{ab} = \sqrt{3}V_p\angle 30^\circ$
	$\mathbf{V}_{bn} = V_p\angle -120^\circ$	$\mathbf{V}_{bc} = \mathbf{V}_{ab}\angle -120^\circ$
	$\mathbf{V}_{cn} = V_p\angle +120^\circ$	$\mathbf{V}_{ca} = \mathbf{V}_{ab}\angle +120^\circ$
	Same as line currents	$\mathbf{I}_a = \mathbf{V}_{an}/\mathbf{Z}_Y$
		$\mathbf{I}_b = \mathbf{I}_a\angle -120^\circ$
		$\mathbf{I}_c = \mathbf{I}_a\angle +120^\circ$
Y-Δ	$\mathbf{V}_{an} = V_p\angle 0^\circ$	$\mathbf{V}_{ab} = \mathbf{V}_{AB} = \sqrt{3}V_p\angle 30^\circ$
	$\mathbf{V}_{bn} = V_p\angle -120^\circ$	$\mathbf{V}_{bc} = \mathbf{V}_{BC} = \mathbf{V}_{ab}\angle -120^\circ$
	$\mathbf{V}_{cn} = V_p\angle +120^\circ$	$\mathbf{V}_{ca} = \mathbf{V}_{CA} = \mathbf{V}_{ab}\angle +120^\circ$
	$\mathbf{I}_{AB} = \mathbf{V}_{AB}/\mathbf{Z}_\Delta$	$\mathbf{I}_a = \mathbf{I}_{AB}\sqrt{3}\angle -30^\circ$
	$\mathbf{I}_{BC} = \mathbf{V}_{BC}/\mathbf{Z}_\Delta$	$\mathbf{I}_b = \mathbf{I}_a\angle -120^\circ$
	$\mathbf{I}_{CA} = \mathbf{V}_{CA}/\mathbf{Z}_\Delta$	$\mathbf{I}_c = \mathbf{I}_a\angle +120^\circ$
Δ-Δ	$\mathbf{V}_{ab} = V_p\angle 0^\circ$	Same as phase voltages
	$\mathbf{V}_{bc} = V_p\angle -120^\circ$	
	$\mathbf{V}_{ca} = V_p\angle +120^\circ$	
	$\mathbf{I}_{AB} = \mathbf{V}_{ab}/\mathbf{Z}_\Delta$	$\mathbf{I}_a = \mathbf{I}_{AB}\sqrt{3}\angle -30^\circ$
	$\mathbf{I}_{BC} = \mathbf{V}_{bc}/\mathbf{Z}_\Delta$	$\mathbf{I}_b = \mathbf{I}_a\angle -120^\circ$
	$\mathbf{I}_{CA} = \mathbf{V}_{ca}/\mathbf{Z}_\Delta$	$\mathbf{I}_c = \mathbf{I}_a\angle +120^\circ$
Δ-Y	$\mathbf{V}_{ab} = V_p\angle 0^\circ$	Same as phase voltages
	$\mathbf{V}_{bc} = V_p\angle -120^\circ$	
	$\mathbf{V}_{ca} = V_p\angle +120^\circ$	
	Same as line currents	$\mathbf{I}_a = \dfrac{V_p\angle -30^\circ}{\sqrt{3}\mathbf{Z}_Y}$
		$\mathbf{I}_b = \mathbf{I}_a\angle -120^\circ$
		$\mathbf{I}_c = \mathbf{I}_a\angle +120^\circ$

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