KOLEJ YAYASAN PELAJARAN JOHOR

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FINAL EXAMINATION

COURSE NAME	:	**TEKNOLOGI ELEKTRIK**
COURSE CODE	:	**DEG 1082**
EXAMINATION	:	**APRIL 2018**
DURATION	:	**2 HOURS**

INSTRUCTION TO CANDIDATES

1. This examination paper consists of **FIVE (5)** questions. Answer **FOUR (4)** questions only in the answer booklet provided.

2. Candidates are not allowed to bring any material to examination room except with the permission from the invigilator.

3. Please check to make sure that this examination pack consist of:
   i. Question Paper
   ii. Answer Booklet
   iii. Attachment 1

DO NOT TURN THIS PAGE UNTIL YOU ARE TOLD TO DO SO

*This examination paper consists of **10** printed pages including front page*

This paper contains of **FIVE(5)** questions. Answer **FOUR (4)** questions only in the Answer Booklet.
*Kertas soalan ini mengandungi **LIMA (5)** soalan. Jawab **EMPAT (4)** soalan sahaja di dalam buku jawapan yang disediakan.*

QUESTION 1 / *SOALAN 1*

a. Explain briefly about power factor correction.
Terangkan secara ringkas berkenaan pembetulan faktor kuasa.

(3 marks/ *markah*)

b. Name **three (3)** types of alternating current and the unit and provide **three (3)** forms of the equations for each power.
*Namakan **tiga(3)** jenis kuasa arus ulang alik serta unitnya dan berikan **tiga(3)** bentuk persamaan untuk setiap kuasa tersebut.*

(6 marks/ *markah*)

c. A motor having a lagging power factor is connected to a 120 V, 50 Hz supply. The current is 5.2 A and power of 480 watt.

i. Calculate the power factor of the circuit.
ii. Draw the power triangle of the circuit.
iii. If the power factor want to be improved to 0.95 lagging, determine the value of capacitor needed to be connected.

Sebuah motor yang mempunyai faktor kuasa mengekor disambung ke bekalan 120 V, 50 Hz. Arus bekalan ialah 5.2 A dan kuasa 480 watt.

i. Kirakan faktor kuasa litar.
ii. Lukiskan rajah segitiga kuasa litar.
iii. Sekiranya faktor kuasa hendak diperbaiki menjadi 0.95 mengekor, tentukan nilai kapasitor yang perlu disambung.

(16 marks/ *markah*)

QUESTION 2 / *SOALAN 2*

a. With the aid of suitable sketches, show the configurations for power measuring connection using two-wattmeter and three-wattmeter method. State the power equations based from the methods.

Dengan bantuan lakaran yang sesuai, tunjukkan konfigurasi penyambungan untuk mengukur kuasa menggunakan kaedah dua-meterwatt dan tiga-meterwatt. Nyatakan persamaan kuasa kaedah tersebut.

(10 marks/ *markah*)

b. In an electrical power distribution system, the wattmeter are used to measure the three-phase active power. The two-wattmeter or three-wattmeter method is used to measure power. Referring to Figure Q2 (b):

i. determine the phase and line currents.
ii. determine the readings on the wattmeter W_1 and W_2.
iii. draw the phasor diagram of the phase and line currents and voltages.

Dalam sistem penghantaran kuasa elektrik, meterwatt digunakan untuk mengukur kuasa aktif tiga fasa. Kaedah meterwatt disambung samada menggunakan dua meterwatt atau tiga meterwatt. Merujuk Rajah Q2 (b):

i. tentukan arus fasa dan talian.
ii. tentukan bacaan meterwatt W_1 and W_2.
iii. lukiskan rajah pemfasa arus dan voltan fasa dan talian.

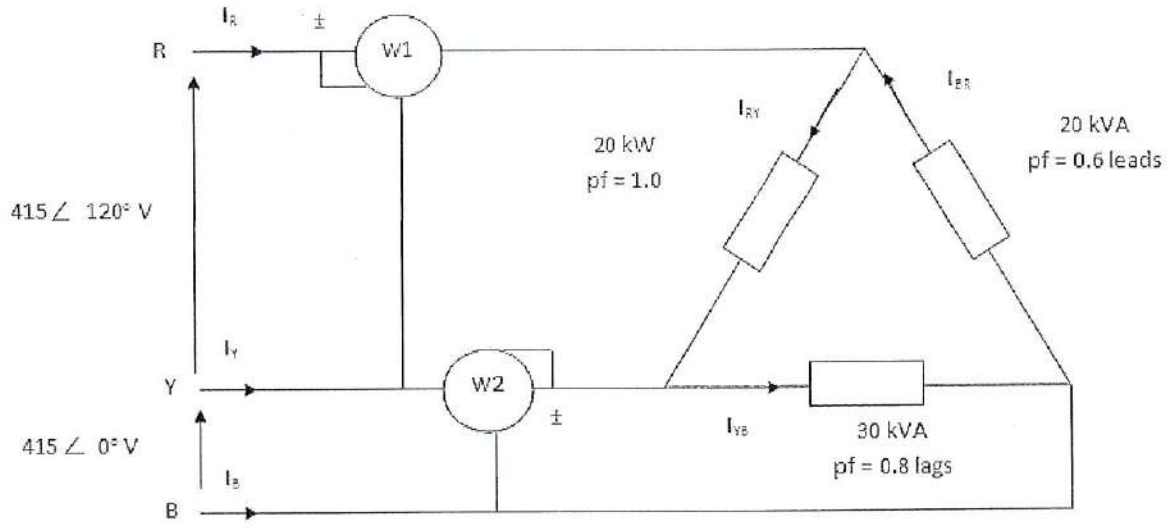

Figure Q2 (b) / *Rajah Q2 (b)*

(15 marks/ *markah*)

QUESTION 3 / *SOALAN 3*

a. State **two (2)** types of losses in magnetic circuit.

*Nyatakan **dua (2)** jenis kehilangan yang terdapat dalam litar magnet.*

(2 marks/ *markah*)

b. Explain briefly the following terms with the reference to a magnetic circuit.
   i. Magnetomotive force (mmf)
   ii. Magnetic field strength (H)
   iii. Flux density (B)

Nyatakan secara ringkas sebutan-sebutan berikut merujuk kepada litar magnet.

i. Daya gerak magnet (dgm)

ii. Kekuatan medan magnet (H)

iii. Ketumpatan fluks (B)

(6 marks/ *markah*)

c. A magnetic relay shown in Figure Q3 (c) is wound with a coil of 500 turns. The flux pathway has a uniform cross-sectional area of 25 cm^2. The 'U' shape core is made of iron cast which has the magnetization characteristics as shown in Table Q3 (c). The horizontal bar is made of the same material. There are two air-gaps, each 1.5 mm long and a flux of 1000 μWb is needed to move the bar. Neglecting any magnetic fringing and leakage flux.

i. Sketch the equivalent circuit of the magnetic circuit accordingly.

ii. Determine the exciting current in the core winding.

iii. Calculate the value of absolute permeability as well as relative permeability for the 'U' shape core.

iv. Find the current in the core winding when the same flux of 1000 μWb is applied, if the air gaps length is zero.

v. Calculate total mechanical work done to move the bar to 3 mm from position (iv) by assuming the flux permanently remains the same in the core.

Sebuah geganti magnetik ditunjukkan dalam Rajah Q3 (c) dililitkan dengan gegelung sebanyak 500 lilitan. Luas keratan rentas untuk laluan fluks adalah 25 cm^2 seragam. Teras berbentuk 'U' diperbuat daripada besi tuangan yang mempunyai data permagnetan seperti dalam Jadual Q3 (c). Teras bar diperbuat daripada bahan yang sama. Panjang sela udara adalah 1.5 mm setiap satu dan fluks sebanyak 1000 μWb diperlukan teras bagi menggerakkan teras bar tersebut. Dengan mengabaikan kesan pinggiran dan fluks bocor.

i. *Lukiskan litar setara elektrik bagi litar magnetik tersebut.*

ii. *Dapatkan nilai arus dalam gegelung.*

iii. *Kirakan nilai ketelapan mutlak dan ketelapan relatif bagi teras berbentuk 'U'.*

iv. *Jika panjang sela udara adalah sifar, dapatkan arus dalam gegelung untuk jumlah fluks yang sama, 1000 μWb dalam teras.*

v. *Jumlah kerja mekanikal yang dilakukan untuk menggerakkan teras bar sejauh 3 mm dari kedudukan (iv) dengan menganggap fluks dalam teras adalah kekal.*

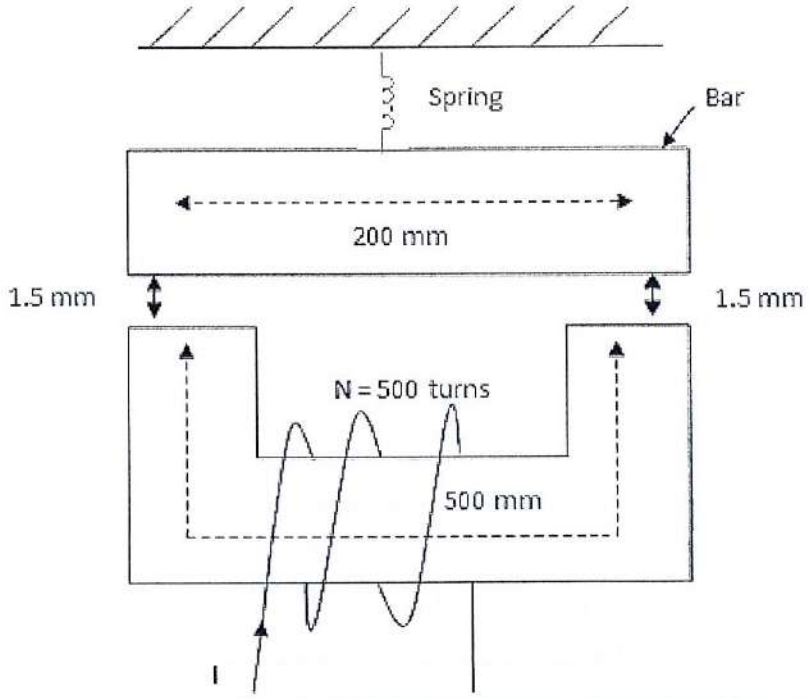

Figure Q3 (c) / *Rajah Q3 (c)*

B (Tesla)	0.2	0.4	0.6	0.8	1.0	1.2
H (AL/m)	100	330	430	510	610	690

Table Q3 (c) / *Jadual Q3 (c)*

(17 marks/ *markah*)

QUESTION 4 / *SOALAN 4*

a. State **four (4)** basic principle methods to reduce the leakage flux in a transformer.

*Nyatakan **empat (4)** kaedah asas bagi mengurangkan kesan kebocoran fluks dalam pengubah.*

(4 marks/ *markah*)

b. Give a brief explanation on the procedure for the open-circuit transformer test.

Berikan penerangan ringkas mengenai prosedur bagi ujian litar buka pengubah.

(6 marks/ *markah*)

c. The test data from a single-phase 1kVA, 240 V/100V transformers is shown as Table Q4 (c). Determine:

i. core loss current and the current required to develop magnetic flux in the core.
ii. equivalent circuit referred to low voltage side.
iii. voltage regulation and efficiency of the transformer when operating at half full-load with power factor 0.85 lagging. (Hint: Use the approximate equivalent circuit for the calculations)

Data ujian untuk pengubah satu-fasa 1kVA, 240 V/100V adalah seperti dalam Jadual Q4 (c). Tentukan:

i. arus kehilangan besi dan arus yang diperlukan untuk membina fluks magnet dalam teras.
ii. litar setara pengubah dirujuk ke bahagian voltan rendah.

iii. *pengaturan voltan dan kecekapan apabila pengubah beroperasi pada separuh beban penuh dengan faktor kuasa 0.85 mengekor. (Panduan : Gunakan litar setara hampiran bagi pengiraan tersebut)*

	Open circuit test (at rated voltage) *Ujian litar buka (pada voltan terkadar)*	Short circuit test (at rated current) *Ujian litar pintas (pada arus terkadar)*
Voltage / *Voltan*	100 V	15 V
Current / *Arus*	2 A	4.16 A
Power / *Kuasa*	80 W	40 W

Table Q4 (c) / *Jadual Q4 (c)*

(15 marks/ *markah*)

QUESTION 5 / *SOALAN 5*

a. Name **two (2)** types of armature winding arrangement.

*Namakan **dua (2)** jenis susunan bagi belitan angkir.*

(2 marks/ *markah*)

b. The generation of voltage for a DC generator depends on several factors. List down **four (4)** factors contributing to the amount of voltage generated in the DC generator.

*Penghasilan voltan bagi penjana AT bergantung kepada beberapa faktor. Senaraikan **empat (4)** faktor yang menyumbang kepada penghasilan jumlah voltan yang terjana oleh penjana AT.*

(4 marks/ *markah*)

c. A shunt field DC generator, delivers a terminal voltage of 125 V to a resistance load of 25 Ω. The generator has a field and armature resistances of 250 Ω and 0.1 Ω respectively. If the total carbon brush drop is 2 V, determine:

i. the DC generator circuit.
ii. the load current.
iii. the field current.
iv. the power at field.
v. the armature current.
vi. induced e.m.f at the armature.
vii. the total power delivered to the load.

Penjana AT medan pirau membekalkan voltan terminal sebanyak 125 V kepada beban perintang sebanyak 25 Ω. Penjana tersebut mempunyai rintangan medan dan angkir sebanyak 250 Ω dan 0.1 Ω masing-masing. Jika jumlah kejatuhan voltan pada berus karbon adalah sebanyak 2 V, tentukan:

i. gambar rajah litar bagi penjana AT tersebut.
ii. arus beban.
iii. arus medan.
iv. kuasa pada medan.
v. arus angkir.
vi. d.g.e teraruh pada angkir.
vii. jumlah kuasa yang dibekalkan kepada beban.

(19 marks/ *markah*)

[100 MARKS / 100 MARKAH]

ATTACHMENT *1* / *LAMPIRAN 1*

$$V = IZ$$

$$pf = \frac{P}{S} = \cos\theta_z$$

$$X_C = \frac{V^2}{Xc}$$

$$C = \frac{1}{\omega X_C}$$

$$V_T = \sqrt{3}V_F$$

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

$$Dgm, F = Hl = NI$$

$$\theta_{lb} = \cos^{-1}\left(\frac{P_{lb}}{V_{lb} x I_{lb}}\right)$$

$$R_C = \frac{V_{lb}}{I_c}$$

$$X_m = \frac{V_{lb}}{I_m}$$

$$R_{sn} = \frac{P_{lb}}{I_p^{\ 2}}$$

$$Z_{sn} = \frac{V_{lp}}{I_{lp}}$$

$$X_{sn} = j\sqrt{Z_{sn}^{\ 2} - R_{sn}^{\ 2}}$$

$$E = \phi n$$

END OF QUESTION PAPER / KERTAS SOALAN TAMAT