POLITEKNIK
MALAYSIA

BAHAGIAN PEPERIKSAAN DAN PENILAIAN
JABATAN PENDIDIKAN POLITEKNIK
KEMENTERIAN PENDIDIKAN TINGGI

JABATAN KEJURUTERAAN ELEKTRIK

PEPERIKSAAN AKHIR

SESI DISEMBER 2016

DET2033: ELECTRICAL CIRCUITS

TARIKH : 02 APRIL 2017
MASA : 8.30 AM – 10.30 AM (2 JAM)

Kertas ini mengandungi **SEBELAS (11)** halaman bercetak.

Bahagian A : Objektif (10 soalan)
Bahagian B : Struktur (4 soalan)
Bahagian C : Esei (2 soalan)

Dokumen sokongan yang disertakan : Tiada

JANGAN BUKA KERTAS SOALAN INI SEHINGGA DIARAHKAN

(CLO yang tertera hanya sebagai rujukan)

SECTION A : 10 MARKS
BAHAGIAN A : 10 MARKAH

INSTRUCTION:

This section consists of **TEN (10)** objective questions. Mark your answers in the OMR form provided.

ARAHAN :

*Bahagian ini mengandungi **SEPULUH (10)** soalan objektif. Tandakan jawapan anda di dalam borang OMR yang disediakan.*

CLO1
C1

1. Identify the voltage equation for waveform B in Figure A1.
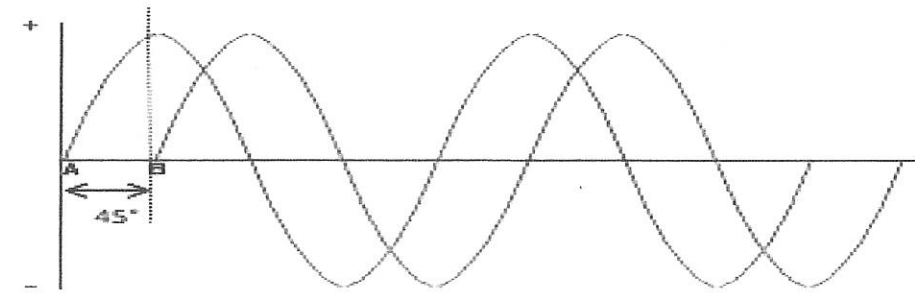   *Kenal pasti persamaan voltan untuk gambar rajah gelombang dalam Rajah A1.*

Figure A1/*Rajah A1*

A. $e = e_m \sin \omega t$

B. $e = e_m \sin 45°$

C. $e = e_m \sin (\omega t + 45°)$

D. $e = e_m \sin (\omega t - 45°)$

CLO1
C2

2. Identify the capacitive reactance (Xc), when the frequency increases.
    Kenal pasti regangan kapasitif (Xc), bila frekuensi meningkat.

A. Increase
    Meningkat

B. Decrease
    Menurun

C. Remain constant
    Keadaan tetap (Tidak berubah)

D. None of the above
    Tiada satu pun diatas

CLO1
C2

3. Select the current when a series of RLC circuit is operating below the resonant frequency.

Pilih arus di dalam litar RLC siri yang berkendali di bawah frekuensi resonan.

A. lags the applied voltage
   mengekori voltan yang dikenakan

B. It is in phase with the applied voltage
   sefasa dengan voltan yang dikenakan

C. leads the applied voltage
   mendahului voltan yang dikenakan

D. It is zero
   sifar

CLO1
C2

4. In a balanced three phase DELTA connected system, the relationship between the rms values of the line current and the phase current is given by:

Dalam sistem tiga fasa seimbang sambungan DELTA, hubungan antara nilai ppgd arus talian dan arus fasa adalah ditunjukkan oleh:

A. $I_L = I_{ph}$

B. $I_L = \sqrt{3}\ I_{ph}$

C. $I_{ph} = \sqrt{3}\ I_L$

D. $I_L = \sqrt{2}\ I_{ph}$

CLO1
C1

5. Define an advantage of auto-transformer.

Tentukan kelebihan pengubah auto.

A. iron losses are reduced.
   mengurangkan kadar kehilangan besi.

B. copper loss is reduced.
   mengurangkan kadar kehilangan kuprum.

C. it gives a high step-up ratio.
   meningkatkan nisbah langkah naik.

D. it reduces capacitance between turns.
   mengurangkan kemuatan antara belitan.

CLO1
C2

6. In a single-phase transformer, the secondary voltage and primary voltage is 3.45kV and 6.6kV respectively. Secondary current is 2.15 A. Calculate the primary current for the transformer.

Bagi penggubah satu fasa, voltan sekunder dan voltan primer adalah 3.45kV dan 6.6kV masing-masing. Arus sekunder adalah 2.15 A. Kira arus primer bagi penggubah tersebut.

A. 4.11A

B. 2.124kA

C. 3.11kA

D. 1.124A

CLO2
C3

7. An alternating voltage is given as e = 150 sin (628.4 t −0.41) volt. Determine the voltage if this wave is measured by voltmeter.

Diberi voltan ulangalik sebagai e = 150 sin (628.4 t −0.41) volt. Dapatkan nilai voltan jika gelombang ini diukur menggunakan jangka volt.

A. 44.59V

B. 106V

C. 150V

D. 141.42V

CLO2
C3

8. Based on the circuit given in Figure A2, calculate impedance value (Z).

Berdasarkan litar yang diberikan dalam Rajah A2, kira nilai galangan (Z).
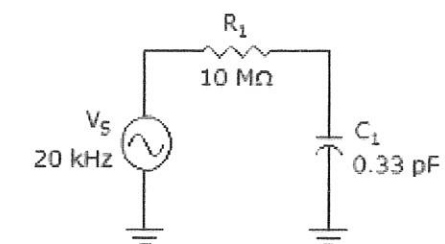

Figure A2 / *Rajah A2*

A. 24.1 MΩ

B. 26.1 MΩ

C. 0 Ω

D. 15 MΩ

CLO2
C3

9.   Calculate the quality factor (Q) of a series circuit that resonates at 6 KHz, has equal reactance of 4 KΩ each and a resistor value of 50Ω.

Kirakan faktor kualiti (Q) litar siri yang berada dalam keadaan salun pada 6 KHz, mempunyai nilai reaktans yang sama iaitu 4 KΩ setiapnya dan nilai perintang 50 Ω.

A. 50

B. 500

C. 80

D. 0.8

CLO2
C3

10.   Based on Figure A3 below, it is given V_{Line} = 415V, 50Hz. If R=200Ω in series with X_C=300Ω. Calculate the line current.

Berdasarkan Rajah A3 dibawah, diberi nilai V_{Line} = 415V, 50Hz. Jika diberi R=200Ω sesiri dengan X_C=300Ω. Kira arus talian.

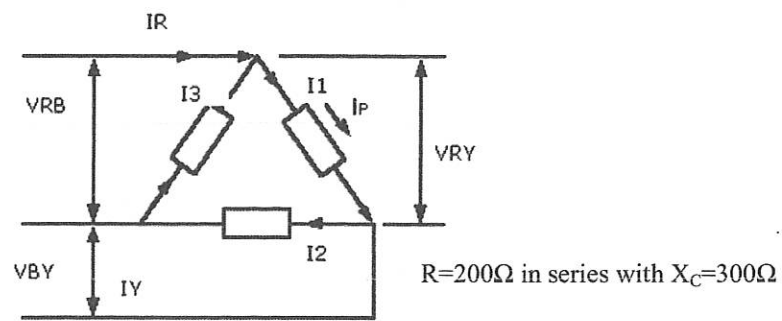Figure A3 / *Rajah A3*

A. 1.15A

B. 2.05A

C. 3.47A

D. 1.99A

SECTION B : 60 MARKS

BAHAGIAN B :60 MARKAH

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

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

QUESTION 1

SOALAN 1

CLO1
C1

(a)   State **TWO (2)** advantages of alternating current compared to direct current.

*Nyatakan **DUA (2)** kelebihan arus ulang alik berbanding arus terus.*

[3 marks]

[*3 markah*]

CLO1
C2

(b)   Explain briefly Faraday's and Lenz's Law involved in generating alternating current.

Terangkan dengan ringkas Hukum Faraday's dan Lenz's di dalam menjana arus ulang alik .

[5 marks]

[*5 markah*]

CLO2
C3

(c)   An alternating current is given i(t) = 100 sin   (200π t + 0.45) A. Calculate the period , Root Mean Square (RMS) value and the instantaneous value when t=0s.

Satu arus ulang alik mempunyai persamaan i(t) = 100 sin (200πt + 0.45) A. Kira Tempoh , Nilai Purata Punca Ganda Dua (PPGD) dan nilai arus seketika bila t = 0s.

[7 marks]

[*7 markah*]

QUESTION 2

SOALAN 2

CLO1
C1

(a)   With the aid of a diagram, state the relationship between the voltage and the current for pure inductive circuit.

Dengan bantuan gambarajah, nyatakan hubungan antara voltan dan arus untuk litar kearuhan tulin.

[3 marks]
[*3 markah*]

CLO1
C2

(b)   Referring to Figure B1, determine the total impedance, Z_T for the series circuit which has a frequency of 20 kHz.

Merujuk kepada Rajah B1, tentukan jumlah galangan , Z_T untuk litar siri tersebut yang mempunyai frekuensi 20kHz.
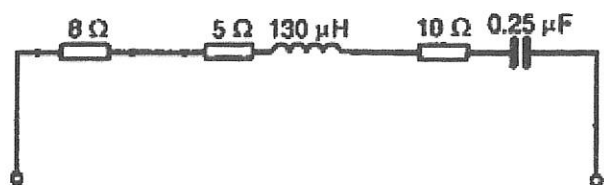

8 Ω   5 Ω 130 µH   10 Ω 0.25 µF

Figure B1 / *Rajah B1*

[5 marks]
[*5 markah*]

CLO2
C3

(c)   Referring to Figure B2, a coil of inductance 0.12H and resistance 3kΩ is connected in parallel with a 0.02µF capacitor across a 240V, 50 Hz supply. Find the value of the total current I, flows in the circuit.

Berdasarkan Rajah B2, satu gegelung kearuhan 0.12H dan rintangan 3kΩ disambung secara selari dengan kapasitor 0.02µF merentasi bekalan 240V, 50 Hz . Cari nilai jumlah arus I, yang mengalir dalam litar.
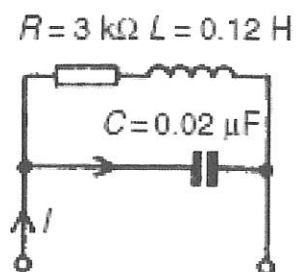

$R = 3$ kΩ $L = 0.12$ H

$C = 0.02$ µF

I

Figure B2 / *Rajah B2*

[7 marks]
[*7 markah*]

QUESTION 3

SOALAN 3

CLO1
C1

(a)   A three-phase generator connected in DELTA, supplies 120V as line voltage (V_L) and 30A as line current (I_L). What is the value of the current for each phase (I_p)

Satu penjana tiga fasa sambungan DELTA, menghasilkan 120V voltan talian (V_L) dan 30A arus talian (I_L). Berapakah arus pada setiap fasa (I_f).

[3 marks]
[*3 markah*]

CLO1
C2

(b)   With the aid of a diagram, differentiate the STAR and DELTA connections for 3 phase system and label all the phases involved.

Dengan bantuan gambarajah yang sesuai, bezakan penyambungan BINTANG dan DELTA bagi sistem 3 fasa dan labelkan semua fasa yang terlibat.

[5 marks]
[*5 markah*]

CLO2
C3

(c)   A 400V, 3-phase, 4 wire, STAR connected system supplies three resistive loads of 18kW, 25kW and 28kW in the red, yellow and blue phases respectively. Determine the current flowing through each of the red, yellow and blue phase.

Satu bekalan 3 fasa, 400V, 4 wayar, sistem sambungan BINTANG membekalkan tiga beban rintangan masing-masing berkuasa 18kW, 25kW dan 28kW bagi fasa merah, kuning dan biru. Tentukan arus yang mengalir melalui setiap fasa merah, kuning dan biru tersebut.

[7 marks]
[*7 markah*]

QUESTION 4

SOALAN 4

CLO1
C1

(a)   List **THREE (3)** types of losses which happen to a transformer.

*Senaraikan **TIGA (3)** jenis kehilangan yang berlaku pada pengubah.*

[3 marks]
[3 markah]

CLO1
C2

(b)   Identify **FIVE (5)** characteristics of an Ideal Transformer.

*Kenal pasti **LIMA (5)** ciri bagi Pengubah Unggul.*

[5 marks]
[5 markah]

CLO2
C3

(c)   Referring to Figure B3;

     i)   Calculate the secondary voltage (Vs), primary current (Ip) and secondary current (Is).

     ii)   State type of the transformer.

Merujuk Rajah B3;

     i)   *Kirakan voltan sekunder (Vs), arus primer (Ip) dan arus sekunder (I_s).*
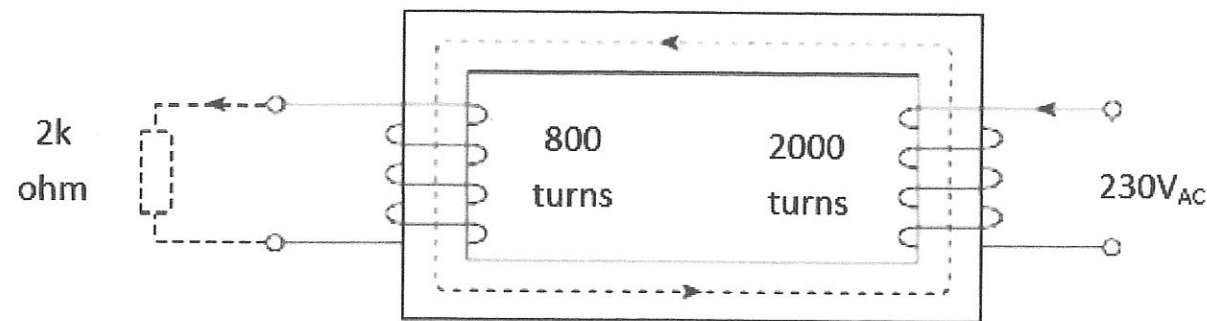
     ii)   *Nyatakan jenis pengubah tersebut.*

Figure B3/*Rajah B3*

[7marks]
[7 markah]

SECTION C: 30 MARKS

BAHAGIAN C: 30 MARKAH

INSTRUCTION:
This section consists of **TWO (2)** essay questions. Answer **ALL** questions.

ARAHAN:
*Bahagian ini mengandungi **TWO (2)** soalan esei. Jawab **SEMUA** soalan.*

CLO2
C3

QUESTION 1

SOALAN 1

A 100Ω resistor, a 0.5H coil , a 10μF capacitor and 1H coil are all connected in series to 100V, 50Hz supply as shown in Figure C1. Calculate the total impedance (Zt) of the circuit , total current drawn from the supply (Is) , the voltage across the inductance L_2 (V_{L2}) , power factor (Cos Ø) and the real power (P) dissipation.

Satu perintang 100Ω , gegelung 0.5H , kapasitor 10μF dan gegelung 1H telah di sambung secara siri kepada bekalan 100V,50Hz seperti dalam Rajah C1. Kirakan jumlah galangan (Zt), jumlah arus yang mengalir dari punca bekalan (Is), voltan pada pearuh L2 (V_{L2}) , faktor kuasa (Kos Ø) dan jumlah kuasa sebenar (P) yang diserap.

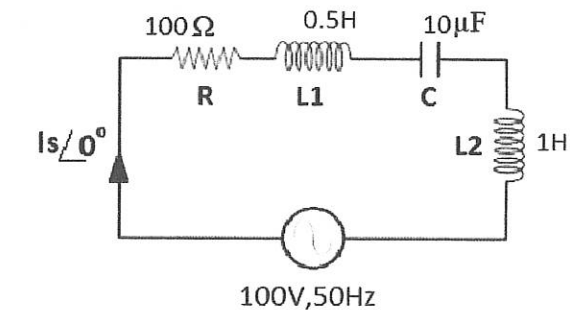Figure C1/*Rajah C1*

[15 marks]
[15 markah]

CLO2
C3

QUESTION 2
SOALAN 2

A circuit which consists of a 25Ω resistor, 2.5mH inductor and a 550pF capacitor is connected in series across 2.5V AC supply. Calculate the upper and lower cut-off frequency. Then sketch the resonance graph Current versus Frequency with the value obtained.

Satu litar yang mengandungi perintang 25Ω, pearuh 2.5mH dan kapasitor 550pF disambung secara siri merentasi voltan bekalan 2.5V AU. Kirakan nilai frekuensi terpotong atas dan bawah. Berdasarkan jawapan yang diperolehi, lakarhan graf resonan Arus melawan Frekuensi.

[15 marks]
[*15 markah*]

SOALAN TAMAT