SULIT

POLITEKNIK MALAYSIA

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

JABATAN KEJURUTERAAN AWAM

PEPERIKSAAN AKHIR

SESI JUN 2018

DCB3092: ELECTRICAL SERVICES 2

TARIKH : 31 OKTOBER 2018
MASA : 2.30 PETANG - 4.30 PETANG (2 JAM)

Kertas ini mengandungi **SEPULUH (10)** halaman bercetak.
Bahagian A: Esei Berstruktur (2 soalan)
Bahagian B: Esei Berstruktur (4 soalan)
Dokumen sokongan yang disertakan : FORMULA

JANGAN BUKA KERTAS SOALAN INI SEHINGGA DIARAHKAN

(CLO yang tertera hanya sebagai rujukan)

SECTION A : 50 MARKS
BAHAGIAN A : 50 MARKAH

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

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

QUESTION 1
SOALAN 1

CLO1
C1

(a) i. Define Emergency Power System.

Takrifkan Sistem Kuasa Kecemasan.

[2 marks]
[*2 markah*]

ii. List **TWO (2)** main forms of Standby Power Supply Unit and give **ONE (1)** example for each form.

*Senaraikan **DUA (2)** bentuk utama bagi Unit Bekalan Kuasa Tunggu Sedia dan berikan **SATU (1)** contoh bagi setiap bentuk.*

[3 marks]
[*3 markah*]

CLO1
C2

(b) Explain the following parts of Standby Generator System:
Terangkan bahagian Sistem Janakuasa Tunggu Sedia yang berikut:

i. Automatic transfer switch
Suis pindahan automatik

[2 marks]
[*2 markah*]

ii. Engine
Enjin

[2 marks]
[*2 markah*]

iii. Direct drive coupling
Gandingan pacuan terus

[2 marks]
[*2 markah*]

iv. Fuel tank
Tangki minyak

[2 marks]
[*2 markah*]

CLO1
C2

(c) Describe the function of the following electronic components with the aid of schematic symbol:
Huraikan fungsi bagi setiap komponen elektronik yang berikut dengan bantuan simbol skematik:

i. Capacitor
Pemuat

[4 marks]
[*4 markah*]

ii. Transistor
Transistor

[4 marks]
[*4 markah*]

iii. Diode
Diod

[4 marks]
[*4 markah*]

QUESTION 2
SOALAN 2

CLO1
C1

(a) List **FIVE (5)** stages involved in a wired telephone connection.
*Senaraikan **LIMA (5)** peringkat yang terlibat dalam pemasangan wayar telefon.*

[5 marks]
[*5 markah*]

CLO1
C2

(b) Explain the following modes of communication with the aid of a diagram:
Terangkan kaedah komunikasi yang berikut dengan bantuan gambarajah berlabel:

i. Simplex
Simpleks

[4 marks]
[*4 markah*]

ii. Full-duplex
Dupleks-penuh

[4 marks]
[*4 markah*]

CLO1
C2

(c) Explain the differences between Inverting and Non-Inverting Amplifier by using the top view of Operational Amplifier diagram.
Terangkan perbezaan di antara Penguat Songsang dan Penguat Bukan Songsang dengan menggunakan gambarajah pandangan atas Penguat Kendalian.

[12 marks]
[*12 markah*]

SECTION B : 50 MARKS
BAHAGIAN B : 50 MARKAH

INSTRUCTION:
This section consists of **FOUR (4)** structured essay questions. Answer **TWO (2)** questions only.

ARAHAN:
*Bahagian ini mengandungi **EMPAT (4)** soalan esei berstruktur. Jawab **DUA (2)** soalan sahaja.*

QUESTION 1
SOALAN 1

CLO2 C2

(a) An 8-pole d.c. shunt generator supplies a load resistance of 25Ω at terminal voltage of 250V. The armature resistance is 0.25Ω and the field resistance is 250Ω. Calculate the armature current.

Sebuah penjana pirau a.t. 8-kutub membekalkan rintangan beban 25Ω pada voltan terminal 250V. Rintangan angker ialah 0.25Ω dan rintangan medan ialah 250Ω. Kirakan arus angker.

[5 marks]
[*5 markah*]

CLO2 C3

(b) A long shunt compound generator delivers a load current of 100A at 1000V. It has armature resistance, series field resistance and shunt field resistance of 0.5Ω, 0.1Ω and 250Ω respectively. Calculate the series field current and the e.m.f. generated.

Sebuah penjana majmuk pirau panjang membekalkan arus beban 100A pada 1000V. Ia mempunyai rintangan angker, rintangan medan siri dan rintangan medan pirau masing-masing ialah 0.5Ω, 0.1Ω dan 250Ω. Kirakan arus medan siri dan d.g.e. yang terjana.

[8 marks]
[*8 markah*]

CLO2
C3

(c) A 4-pole d.c. generator with 60 slots and 10 conductors per slot is driven at 1500r.p.m.The flux per pole is 0.04Wb. Calculate the generated e.m.f. if the armature winding is:
Sebuah penjana a.t. 4-kutub dengan 60 alur dan 10 pengalir bagi setiap alur didorong pada 1500p.s.m. Fluks per kutub ialah 0.04Wb. Kirakan d.g.e. yang terjana jika belitan angker ialah:

i. lap connected
sambungan tindih

[6 marks]
[*6 markah*]

ii. wave connected
sambungan gelombang

[6 marks]
[*6 markah*]

QUESTION 2
SOALAN 2

CLO2
C2

(a) A 4-pole d.c. shunt motor lap wound armature has 650 conductors. The flux per pole is 0.03Wb. Calculate the armature torque when the armature current is 40A.
Sebuah motor pirau a.t. 4-kutub angker belitan tindih mempunyai 650 pengalir. Fluks per kutub ialah 0.03Wb. Kirakan daya kilas angker jika arus angker ialah 40A.

[5 marks]
[*5 markah*]

CLO2
C3

(b) A d.c. shunt motor takes 30A from a 230V. If the field resistance is 160Ω and armature resistance is 0.4Ω, calculate the total copper losses.
Sebuah motor pirau a.t. mengambil 30A dari 230V. Jika rintangan medan ialah 160Ω dan rintangan angker ialah 0.4Ω, kirakan jumlah kehilangan kuprum.

[8 marks]
[*8 markah*]

CLO2
C3

(c) A shunt motor running at 600r.p.m takes 80A at 250V. The armature and shunt field resistances are 0.1Ω and 50Ω respectively. Iron and frictional losses is 2188W. Calculate:
Sebuah motor pirau bergerak pada 600p.s.m mengambil 80A di 250V. Rintangan angker dan medan pirau ialah 0.1Ω dan 50Ω masing-masing. Kehilangan besi dan geseran ialah 2188W. Kirakan:

i. armature torque
daya kilas angker

[6 marks]
[*6 markah*]

ii. copper losses
kehilangan kuprum

[3 marks]
[*3 markah*]

iii. efficiency
kecekapan

[3 marks]
[*3 markah*]

QUESTION 3
SOALAN 3

CLO2
C2

(a) A 16-pole, 3-phase alternator has a star connected alternator with 144 slots and 10 conductors per slot. The flux per pole is 0.03Wb distributed sinusoidally and the speed is 375r.p.m. Calculate the e.m.f. generated/phase. ($K_d = 0.96$ and $K_p = 1$)
Sebuah alternator 3-fasa, 16-kutub mempunyai sambungan bintang dengan 144 alur dan 10 pengalir bagi setiap slot. Fluks per kutub ialah 0.03Wb diagihkan secara sinusoidal dan kelajuan ialah 375p.s.m. Kirakan nilai e.m.f terjana/fasa. ($K_d = 0.96$ dan $K_p = 1$)

[5 marks]
[*5 markah*]

CLO2
C3

(b) An a.c. motor 415V, 3-phase, 8-pole, 50Hz, star connected runs at 5% slip. Calculate:
Sebuah motor a.u. 415V, 3-fasa, 8-kutub, 50Hz, sambungan bintang beroperasi pada 5% gelincir. Kirakan:

i. the speed of the rotational magnetic field
kelajuan pada medan magnet berputar

[2 marks]
[*2 markah*]

ii. the speed of the rotor
kelajuan pada pemutar

[2 marks]
[*2 markah*]

iii. the slip speed
kelajuan gelincir

[2 marks]
[*2 markah*]

iv. the frequency of the induced e.m.f. in the rotor
frekuensi pada d.g.e. teraruh di dalam pemutar

[2 marks]
[*2 markah*]

CLO2
C3

(c) A 75kVA transformer has iron losses 500W and full-load copper losses 1200W. Calculate the efficiency at full-load and half-load at unity power factor.
Sebuah alatubah 75kVA mempunyai kehilangan besi 500W dan kehilangan kuprum beban penuh 1200W. Kirakan kecekapan pada beban penuh dan beban separa penuh pada faktor kuasa uniti.

[12 marks]
[*12 markah*]

QUESTION 4
SOALAN 4

CLO2 C2 (a) A 600/1000V step-up single-phase transformer has 300 turns on its primary winding. Calculate secondary turns.
Sebuah alatubah langkah-naik satu-fasa 600/1000V mempunyai 300 lilitan pada belitan primer. Kirakan belitan sekunder.

[5 marks]
[*5 markah*]

CLO2 C3 (b) Calculate the High Transformer and Low Transformer full-load current of a 12kV/300V, 400kVA transformer. Neglect all other factors.
Kirakan arus Alatubah Tinggi dan Alatubah Rendah berbeban penuh bagi 12kV/300V, 400kVA alatubah. Abaikan semua faktor-faktor lain.

[8 marks]
[*8 markah*]

CLO2 C3 (c) In a 50kVA transformer, the iron loss is 500W and full-load copper loss is 800W. Calculate its efficiency at full-load at:
Pada sebuah alatubah 50kVA, kehilangan besi ialah 500W dan kehilangan kuprum ialah 800W. Kirakan kecekapan berbeban penuh pada:

i. unity power factor
faktor kuasa uniti

[6 marks]
[*6 markah*]

ii. 0.8 power factor
faktor kuasa 0.8

[6 marks]
[*6 markah*]

SOALAN TAMAT

FORMULA

DC generator

$$E_g = \frac{\phi ZN}{60} \times \frac{P}{A}$$

$$\eta = \frac{VI_L}{VI_L + losses} \times 100\%$$

Shunt wound generator

$$I_{sh} = \frac{V}{R_{sh}}$$

$$I_a = I_L + I_{sh}$$

$$V_T = E_g - I_a R_a$$

$$P_a = E_g I_a$$

$$P_L = VI_L$$

Series wound generator

$$I_a = I_L = I_{se} = I$$

$$V_T = E_g - I(R_a + R_{se})$$

Short shunt compound generator

$$I_{se} = I_L$$

$$I_a = I_L + I_{sh}$$

$$I_{sh} = \frac{V + I_{se}R_{se}}{R_{sh}}$$

$$V_T = E_g - I_{se}R_{se} - I_a R_a$$

Long shunt compound generator

$$I_{se} = I_a = I_L + I_{sh}$$

$$I_{sh} = \frac{V}{R_{sh}}$$

$$V_T = E_g - I_a(R_a + R_{se})$$

DC motor

$$E_b = \frac{P\phi NZ}{60A}$$

$$T_a = 0.159\phi ZP \times \frac{I_a}{A}$$

$$T_a = 9.55 \times \frac{E_b I_a}{N}$$

$$F = BLI$$

$$\eta = \frac{VI_L - losses}{VI_L} \times 100\%$$

Shunt wound motor

$$E_b = V - I_a R_a$$

$$I_L = I_a + I_{sh}$$

$$I_{sh} = \frac{V}{R_{sh}}$$

Series wound motor

$$I_a = I_L = I_{se} = I$$

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Short shunt compound motor

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$$I_L = I_a + I_{sh}$$

$$I_{sh} = \frac{E_b}{R_{sh}}$$

$$E_b = V - I_{se}R_{se} - I_a R_a$$

Long shunt compound motor

$$I_{se} = I_a$$

$$I_{sh} = \frac{V}{R_{sh}}$$

$$I_L = I_a + I_{sh}$$

$$E_b = V - I_a(R_a + R_{se})$$

AC generator

$$f = \frac{NP}{120}$$

$$K_d = \frac{\sin\left(\frac{m\beta}{2}\right)}{m\sin\left(\frac{\beta}{2}\right)}$$

$$K_p = \cos\left(\frac{\alpha}{2}\right)$$

$$E_{ph} = 2.22K_pK_dZf\phi$$

$$E_{line} = \sqrt{3}E_{ph}$$

$$E_{line} = E_{ph}$$

AC motor

$$N_s = \frac{120f}{P}$$

$$s = \frac{N_s - N_r}{N_s} \times 100\%$$

$$N_r = N_s(1-s)$$

$$f_r = sf$$

Transformer

$$\frac{E_1}{E_2} = \frac{N_1}{N_2} = \frac{I_2}{I_1}$$

$$E = 4.44fN\phi_m$$

$$\eta_{FL} = \frac{(VA \times p.f)}{(VA \times p.f) + P_i + P_{cu}} \times 100\%$$

$$\eta_{\frac{1}{2}FL} = \frac{\left(\frac{1}{2}VA \times p.f\right)}{\left(\frac{1}{2}VA \times p.f\right) + P_i + \left(\frac{1}{2}\right)^2 P_{cu}} \times 100\%$$

FORMULA

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Shunt wound generator

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$$V_T = E_g - I_a R_a$$

$$P_a = E_g I_a$$

$$P_L = VI_L$$

Series wound generator

$$I_a = I_L = I_{se} = I$$

$$V_T = E_g - I(R_a + R_{se})$$

Short shunt compound generator

$$I_{se} = I_L$$

$$I_a = I_L + I_{sh}$$

$$I_{sh} = \frac{V + I_{se}R_{se}}{R_{sh}}$$

$$V_T = E_g - I_{se}R_{se} - I_a R_a$$

Long shunt compound generator

$$I_{se} = I_a = I_L + I_{sh}$$

$$I_{sh} = \frac{V}{R_{sh}}$$

$$V_T = E_g - I_a(R_a + R_{se})$$

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$$E_{line} = E_{ph}$$

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$$N_s = \frac{120f}{P}$$

$$s = \frac{N_s - N_r}{N_s} \times 100\%$$

$$N_r = N_s(1-s)$$

$$f_r = sf$$

Transformer

$$\frac{E_1}{E_2} = \frac{N_1}{N_2} = \frac{I_2}{I_1}$$

$$E = 4.44fN\phi_m$$

$$\eta_{FL} = \frac{(VA \times p.f)}{(VA \times p.f) + P_i + P_{cu}} \times 100\%$$

$$\eta_{½FL} = \frac{\left(\frac{1}{2}VA \times p.f\right)}{\left(\frac{1}{2}VA \times p.f\right) + P_i + \left(\frac{1}{2}\right)^2 P_{cu}} \times 100\%$$