SULIT

BAHAGIAN PEPERIKSAAN DAN PENILAIAN
JABATAN PENDIDIKAN POLITEKNIK DAN KOLEJ KOMUNITI
KEMENTERIAN PENGAJIAN TINGGI

JABATAN KEJURUTERAAN AWAM

PEPERIKSAAN AKHIR

SESI II : 2021 / 2022

DCB30082: ELECTRICAL MACHINES AND TELECOMMUNICATION SYSTEM

TARIKH : 30 JUN 2022
MASA : 02.30 PETANG – 04.30 PETANG (2 JAM)

Kertas ini mengandungi **ENAM (6)** halaman bercetak.

Bahagian A: Struktur (3 soalan)
Bahagian B: Esei (1 soalan)

Dokumen sokongan yang disertakan : Formula

JANGAN BUKA KERTAS SOALAN INI SEHINGGA DIARAHKAN

(CLO yang tertera hanya sebagai rujukan)

SECTION A : 75 MARKS
BAHAGIAN A : 75 MARKAH

INSTRUCTION:
This section consists of **THREE (3)** structural questions. Answer **ALL** questions.

ARAHAN :
*Bahagian ini mengandungi **TIGA (3)** soalan berstruktur. Jawab **SEMUA** soalan.*

QUESTION 1
SOALAN 1

CLO2
C2

(a) Estimate the armature current of an 8-pole direct current shunt generator that supplies a load resistance of 30W at terminal voltage of 300V. The armature and field resistances are 0.25W and 300W respectively.

Anggarkan arus angker bagi sebuah penjana pirau arus terus 8-kutub yang membekalkan rintangan beban 30W pada voltan terminal 300V. Rintangan angker dan medan masing-masing ialah 0.25W and 300W.

[5 marks]
[*5 markah*]

CLO2
C3

(b) A 6-pole lap wound shunt motor has 750 conductors. The armature and shunt field resistance are 0.08 Ω and 30 Ω respectively. Calculate the speed of the motor if it takes 100A from a D.C supply of 125V. Flux per pole is 20mWb.

Sebuah motor belitan pirau 6-kutub mempunyai bilangan pengalir sebanyak 750. Rintangan bagi angkir dan medan pirau masing-masing ialah 0.08 Ω dan 30 Ω. Kirakan kelajuan motor jika motor tersebut mengambil 100A dari bekalan A.T 125V. Fluks per kutub ialah 20mWb.

[8 marks]
[*8 markah*]

CLO2 C3

(c) A shunt motor running at 750 r.p.m takes 90A at 250V. The armature and shunt field resistances are 0.4 Ω and 50 Ω respectively. Iron and frictional losses amount to 2500W. Calculate the following:

Sebuah motor pirau bergerak pada kelajuan 750 p.s.m dan mengambil 90A pada 250V. Rintangan angkir dan medan pirau masing-masing bernilai 0.4 Ω *dan 50* Ω*. Jumlah kehilangan besi dan geseran ialah 2500W. Kirakan yang berikut:*

i) Armature torque / *Daya kilas angkir*

[6 marks]
[*6 markah*]

ii) Efficiency / *Kecekapan*

[6 marks]
[*6 markah*]

QUESTION 2
SOALAN 2

CLO2 C2

(a) Indicate the number of armature conductors in series per phase required for the armature of a 3-phase, 50Hz, 10-pole alternator. The winding is star-connected and gives a line voltage of 15000V. The flux per pole is 0.20Wb. Assume $K_p = 1$ and $K_d = 1$.

Tentukan bilangan pengalir angkir dalam siri bagi setiap fasa yang diperlukan untuk angkir bagi alternator 3-fasa, 50Hz, 10-kutub. Belitan disambungkan secara sambungan bintang untuk menghasilkan voltan talian 15000V. Fluk setiap kutub ialah 0.20Wb. Anggap $K_p = 1$ *dan* $K_d = 1$.

[5 marks]
[*5 markah*]

CLO2
C3

(b) The frequency of e.m.f in the stator of an 8-pole, 3-phase induction motor is 50Hz and that in the rotor is 2Hz. Determine the following:

Frekuensi d.g.e bagi sebuah pemegun 8-kutub, 3 fasa motor aruhan ialah 50Hz dan pada pemutar adalah 2Hz. Tentukan yang berikut:

i) The slip, S / *Gelincir, S*

[4 marks]
[*4 markah*]

ii) Speed of the rotor, N_r / *Kelajuan rotor, N_r*

[4 marks]
[*4 markah*]

CLO2
C3

(c) A 250kVA, 1100/400V, 50Hz single-phase transformer has 80 turns on a secondary winding. Calculate the followings:

Sebuah alatubah satu-fasa 250kVA, 1100/400V, 50Hz mempunyai nilai belitan sekunder 80 lilitan. Kirakan yang berikut:

i) Flux value / *Nilai fluks*

[6 marks]
[*6 markah*]

ii) Currents flowing through the two windings / *Arus yang melalui melalui kedua-dua belitan*

[6 marks]
[*6 markah*]

QUESTION 3
SOALAN 3

CLO1 C2

(a) Indicate **THREE (3)** advantages of digital signal.
*Nyatakan **TIGA (3)** kelebihan isyarat digital.*

[5 marks]
[*5 markah*]

CLO1 C3

(b) With the aid of diagram, explain the following mode of communication:
Dengan bantuan gambarajah, terangkan mod komunikasi berikut:

i) Simplex / *Simpleks*

[5 marks]
[*5 markah*]

ii) Half duplex / *Dupleks separa*

[5 marks]
[*5 markah*]

CLO1 C3

(c) With the aid of diagram, explain **THREE (3)** advantages of overhead cable.
*Dengan bantuan gambarajah, huraikan **TIGA (3)** kelebihan kabel talian atas.*

[10 marks]
[*10 markah*]

SECTION B : 25 MARKS
BAHAGIAN B : 25 MARKAH

INSTRUCTION:
This section consists of **ONE (1)** essay questions. Answer the questions.

ARAHAN:
*Bahagian ini mengandungi **SATU (1)** soalan esei. Jawab soalan tersebut.*

QUESTION 1
SOALAN 1

CLO1
C2

(a) Explain **TWO (2)** basic points involve on energy saving and efficiency.

*Terangkan **DUA (2)** poin asas melibatkan penjimatan dan kecekapan tenaga.*

[5 marks]
[*5 markah*]

(b) With the aid of diagram, explain about equal rate tariff.

CLO1
C3

Dengan bantuan gambarajah, huraikan tentang tarif sama rata.

[10 marks]
[*10 markah*]

CLO1
C3

(c) With the aid of diagram, explain **TWO (2)** effects if the power factor is 0.9 and 0.7, respectively.

*Dengan bantuan gambarajah, terangkan **DUA (2)** kesan jika faktor kuasa masing-masing ialah 0.9 dan 0.7.*

[10 marks]
[*10 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

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

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

Short shunt compound motor

$$I_{se} = I_L$$

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

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

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

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

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

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

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

$$E_{ph} = 2.22K_p K_d Zf\phi$$

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

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

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

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

$$E = 4.44fN\phi_m$$

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

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