

SULIT



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

JABATAN KEJURUTERAAN AWAM

PEPERIKSAAN AKHIR

SESI I : 2022 / 2023

**DCB30082: ELECTRICAL MACHINES AND
TELECOMMUNICATION SYSTEM**

TARIKH : 15 DISEMBER 2022

MASA : 2.30 PM – 4.30 PM (2 JAM)

Kertas ini mengandungi **LAPAN (8)** halaman bercetak.

Bahagian A: Esei (2 soalan)

Bahagian B: Esei (4 soalan)

Dokumen sokongan yang disertakan : Formula

JANGAN BUKA KERTAS SOALAN INI SEHINGGA DIARAHKAN

(CLO yang tertera hanya sebagai rujukan)

SULIT

SECTION A: 50 MARKS***BAHAGIAN A: 50 MARKAH*****INSTRUCTION:**

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

ARAHAN :

Bahagian ini mengandungi DUA (2) soalan esei. Jawab SEMUA soalan.

QUESTION 1***SOALAN 1***CLO1
C2

- (a) Describe **TWO (2)** benefits of electrical energy efficiency.

Jelaskan DUA (2) manfaat dari kecekapan tenaga elektrik.

[5 marks]

[5 markah]

CLO1
C3

- (b) Explain the concept of tariffs that is commonly imposed to various consumers in Malaysia.

Terangkan konsep tarif yang biasa dikenakan ke atas pelbagai pengguna di Malaysia.

[10 marks]

[10 markah]

CLO1
C3

- (c) There are many factors that cause a low power factor. Explain **FIVE (5)** disadvantages of low power factor.

Terdapat banyak faktor yang menyebabkan faktor kuasa rendah. Terangkan LIMA (5) keburukan faktor kuasa rendah.

[10 marks]

[10 markah]

QUESTION 2

SOALAN 2

- CLO1
C2
- (a) Illustrate the relationship between the transmitter and receiver in a telecommunication system.
- Lakarkan perhubungan di antara penghantar dan penerima di dalam sistem telekomunikasi.*
- [5 marks]
[5 markah]
- CLO1
C3
- (b) With the aid of a diagram, explain 'simplex' and 'half-duplex' mode of communication.
- Dengan bantuan gambarajah, terangkan mod komunikasi 'simpleks' dan 'separa dupleks'.*
- [10 marks]
[10 markah]
- CLO1
C3
- (c) Master Antenna Television (MATV) means many television connection outlets form one master antenna control system. Usually, high-rise apartment houses, hotels, schools, and cluster-based residential area utilizes this kind of television distribution network.
- Determine the function of the head end and a distribution system on MATV with the aid of a diagram.
- Televisyen Antena Induk (MATV) bermaksud sambungan keluaran televisyen daripada satu sistem kawalan antena induk. Biasanya, kediaman apartmen bertingkat, hotel-hotel, sekolah dan kawasan kediaman berasaskan kluster menggunakan rangkaian pengagihan televisyen seperti ini.*
- Tentukan fungsi hujung tamatan dan sistem pengagihan di MATV dengan bantuan gambarajah.*
- [10 marks]
[10 markah]

SECTION B: 50 MARKS***BAHAGIAN B: 50 MARKAH*****INSTRUCTION:**

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

ARAHAN:

Bahagian ini mengandungi EMPAT (4) soalan esei. Jawab DUA (2) soalan sahaja.

QUESTION 1***SOALAN 1***CLO2
C2

- (a) A transformer reduces the 120 V on the primary to 8 V on the secondary. If there are 150 turns on the primary and 10 turns on the secondary, identify the voltage and turn ratios.

Sebuah alatubah menurunkan 120 V pada primer kepada 8 V pada sekunder. Jika terdapat 150 lilitan pada primer dan 10 lilitan pada sekunder, kenalpasti nisbah voltan dan juga lilitan.

[5 marks]

[5 markah]

CLO2
C3

- (b) Calculate the primary and secondary currents for the 110 kVA transformer which has a voltage ratio of 6600/500 V.

Kirakan nilai arus primer dan sekunder bagi alatubah 110 kVA di mana nisbah voltan ialah 6600/500 V.

[8 marks]

[8 markah]

- CLO2
C3 (c) A 200 kVA, 2000/400 V, 50 Hz single-phase transformer has 120 turns on a primary winding. Calculate:

Sebuah alatubah satu-fasa 200 kVA, 2000/400 V, 50 Hz mempunyai 120 lilitan pada belitan primer. Kirakan:

- (i) the flux value
nilai fluks

[4 marks]

[4 markah]

- (ii) the currents flowing through the two windings
arus yang melalui melalui kedua-dua belitan

[8 marks]

[8 markah]

QUESTION 2

SOALAN 2

- CLO2
C2 (a) Estimate the e.m.f. generated by a 4-pole, wave-connected armature having 45 slots with 18 conductors per slot when driven at 1200 r.p.m. The flux per pole is 0.016 Wb.

Anggarkan d.g.e. terjana oleh 4-kutub, sambungan gelombang pada angker mempunyai 45 slot dengan 18 pengalir setiap slot apabila digerakkan pada 1200 p.s.m. Fluks per kutub adalah 0.016 Wb.

[5 marks]

[5 markah]

- CLO2
C3 (b) A long-shunt compound DC generator is connected to the terminal voltage of 300 V and supplies 80 A of current. The armature, series and shunt winding have a resistance of 0.05 Ω , 0.03 Ω and 60 Ω respectively. Calculate the e.m.f generated.

Sebuah penjana AT majmuk pirau-panjang disambungkan ke terminal voltan sebanyak 300 V dan membekalkan arus 80 A. Jumlah rintangan angker, siri dan

belitan pirau masing-masing berjumlah 0.05 Ω , 0.03 Ω dan 60 Ω . Kirakan d.g.e. terjana.

[8 marks]

[8 markah]

CLO2
C3

- (c) A DC shunt wound generator supplies a load current of 15 A at 220 V. If the resistance of armature is 0.4 Ω and shunt field is 110 Ω , calculate:

Sebuah penjana AT medan pirau membekalkan arus bekalan 15 A pada 220 V. Jika rintangan angker ialah 0.4 Ω dan medan pirau ialah 110 Ω , kirakan:

- (i) the e.m.f generated
d.g.e. terjana

[4 marks]

[4 markah]

- (ii) the total copper losses in the generator
jumlah kehilangan kuprum dalam penjana tersebut

[8 marks]

[8 markah]

QUESTION 3**SOALAN 3**CLO2
C2

- (a) A 4-pole DC shunt motor lap-wound armature has 650 conductors. The flux per pole is 0.03 weber. Estimate the armature torque when the armature current is 40 A.

Sebuah motor AT medan pirau 4-kutub angker berbelitan-tindih mempunyai 650 pengalir. Fluks per kutub ialah 0.03 weber. Anggarkan daya kilas angker apabila arus angker ialah 40 A.

[5 marks]

[5 markah]

CLO2
C3

- (b) A DC shunt motor takes 30 A from a 230 V and its efficiency is 80 %. The field resistance is 160 Ω and armature resistance is 0.4 Ω . Calculate the total copper losses.

Sebuah motor AT medan pirau mengambil 30 A dari 230 V dan kecekapannya ialah 80 %. Rintangan medan ialah 160 Ω dan rintangan angker ialah 0.4 Ω . Kirakan jumlah kehilangan kuprum.

[8 marks]

[8 markah]

CLO2
C3

- (c) A shunt motor running at 600 r.p.m. takes 80 A at 250 V. The armature and shunt field resistance are 0.1 Ω and 50 Ω respectively. Iron and frictional losses amount to 2188 W. Calculate:

Sebuah motor pirau bergerak pada kelajuan 600 p.s.m. mengambil 80 A pada 250 V. Rintangan angker dan medan pirau masing-masing ialah 0.1 Ω dan 50 Ω . Jumlah kehilangan besi dan geseran adalah 2188 W. Kirakan:

- (i) the armature torque
daya kilas angker

[6 marks]

[6 markah]

- (ii) the efficiency of the motor
kecekapan motor tersebut

[6 marks]

[6 markah]

QUESTION 4**SOALAN 4**CLO2
C2

- (a) A 3-phase, 50Hz star-connected AC generator has 180 conductors per phase and flux per pole is 0.0543 Wb. Estimate the e.m.f. generated/phase. Assume the winding is full-pitched and the distribution factor to be 0.96.

Sebuah penjana AU sambungan bintang 3-fasa, 50 Hz mempunyai 180 pengalir bagi setiap fasa dan fluks per kutub ialah 0.0543 Wb. Anggarkan d.g.e terjana/fasa. Andaikan belitan ialah jarak penuh dan faktor agihan ialah 0.96.

[5 marks]

[5 markah]

CLO2
C3

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

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

- (i) the slip
gelincir

[2 marks]

[2 markah]

- (ii) the speed of the rotor
kelajuan rotor

[6 marks]

[6 markah]

CLO2
C3

- (c) In a 50 kVA transformer, the iron loss is 500 W and the full-load copper loss is 800 W. Determine the full-load efficiency if the power factor:

Dalam sebuah alatubah 50 kVA, kehilangan besi ialah 500 W dan kehilangan kuprum beban-penuh ialah 800 W. Tentukan kecekapan beban-penuh jika faktor kuasa:

- (i) unity
uniti

[6 marks]

[6 markah]

- (ii) 0.8

[6 marks]

[6 markah]

Notes

Assessment items for this course have covered elements of the Dublin Problem: DP1, DP2, DP3, DP4 and DP7 as mentioned in FEIST.

SOALAN TAMAT

FORMULA

DC generator

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

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

Shunt wound generator

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

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

$$V_T = E_g - I_a R_a$$

$$P_a = E_g I_a$$

$$P_L = VI_L$$

$$P_c = (I_a)^2 R_a + VI_{sh}$$

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

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

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

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

Losses

$$P_c = (I_a)^2 R_a + VI_{sh} \text{ (shunt)}$$

$$P_c = (I_a)^2 R_a + (I_{se})^2 R_{se} + VI_{sh}$$

(compound)

$$\text{Total losses} = P_{in} - P_{out}$$

DC motor

$$E_b = \frac{P \phi N Z}{60 A}$$

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

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

$$F = BLI$$

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

Shunt wound motor

$$E_b = V - I_a R_a$$

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

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

$$\frac{N_1}{N_2} = \frac{E_{b1}}{E_{b2}}$$

Series wound motor

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

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

$$\frac{N_1}{N_2} = \frac{E_{b1}}{E_{b2}} \left(\frac{\phi_1}{\phi_2} \right)$$

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

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

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

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

$$E_{ph} = 2.22 K_p K_d Z f \phi$$

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

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

AC motor

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

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

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

$$f_r = sf$$

Mechanical power = (1-S) x rotor input

Transformer

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

$$E = 4.44 f N \phi_m$$

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

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