

**SULIT**



**BAHAGIAN PEPERIKSAAN DAN PENILAIAN  
JABATAN PENDIDIKAN POLITEKNIK  
KEMENTERIAN PENDIDIKAN TINGGI**

**JABATAN KEJURUTERAAN AWAM**

**PEPERIKSAAN AKHIR  
SESI DISEMBER 2017**

**DCB3092: ELECTRICAL SERVICES 2**

**TARIKH : 10 APRIL 2018  
MASA : 8.30 PAGI – 10.30 PAGI (2 JAM)**

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

Bahagian A: Struktur (2 soalan)  
Bahagian B: Struktur (4 soalan)

Dokumen sokongan yang disertakan : Formula

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**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)** structured questions. Answer **ALL** questions.

**ARAHAN:**

*Bahagian ini mengandungi DUA (2) soalan struktur. Jawab SEMUA soalan.*

**QUESTION 1****SOALAN 1**CLO1  
C1

- (a) i. Describe the main function of a standby generator.

*Terangkan fungsi utama penjana siap sedia.*

[3 marks]

[3 markah]

- ii. List **TWO (2)** types of external fuel supply.

*Senaraikan DUA (2) jenis bekalan bahan api luaran.*

[2 marks]

[2 markah]

CLO1  
C1

- (b) i. Explain the purpose of installing an "Uninterruptible Power Supply".

*Terangkan tujuan memasang "Bekalan Kuasa Tanpa Gangguan".*

[4 marks]

[4 markah]

- ii. List **TWO (2)** benefits of installing it.

*Senaraikan DUA (2) manfaat memasangnya.*

[4 marks]

[4 markah]

CLO1  
C2

(c) A resistor is the most commonly used component in electronic devices.

*Perintang adalah komponen yang paling biasa digunakan di dalam alat-alat elektronik.*

- i. Explain the function of a resistor.

*Terangkan fungsi perintang.*

[3 marks]

[3 markah]

- ii. Draw the schematic symbol of a resistor.

*Lakarkan simbol skematik perintang.*

[3 marks]

[3 markah]

- iii. State **THREE (3)** features of a resistor.

*Senaraikan **TIGA (3)** ciri-ciri perintang.*

[6 marks]

[6 markah]

## QUESTION 2

## SOALAN 2

CLO1  
C1

(a) Define the following basic elements for telecommunication system:

*Takrifkan elemen asas bagi sistem telekomunikasi yang berikut:*i. transmitter. / *pemancar.*ii. receiver. / *penerima.*

[5 marks]

[5 markah]

CLO1  
C2

(b) Explain briefly the following stages of wired connection for telecommunication system:

*Terangkan secara ringkas peringkat sambungan wayar bagi sistem telekomunikasi yang berikut:*i. Telephone Exchange. / *Ibu Sawat Telefon.*ii. Main Distribution Frame. / *Kerangka Agihan Utama.*iii. Cabinet. / *Kabinet.*iv. Distribution Pole. / *Tiang Agihan.*

[8 marks]

[8 markah]

CLO1  
C2

(c) Explain with the aid of a schematic symbol TWO (2) types of capacitors.

*Terangkan dengan bantuan simbol skematik DUA (2) jenis bagi pemuat.*

[12 marks]

[12 markah]

## SECTION B : 50 MARKS

## BAHAGIAN B : 50 MARKAH

## INSTRUCTION:

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

## ARAHAN:

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

## QUESTION 1

## SOALAN 1

CLO2  
C2

- (a) Calculate the armature current of a 20kW, 250V short shunt compound generator.

Given  $R_a = 0.05\Omega$ ,  $R_{se} = 0.025\Omega$  and  $R_{sh} = 100\Omega$ .

*Kirakan arus angker bagi sebuah penjana majmuk pirau pendek 20kW, 250V.*

*Diberi  $R_a = 0.05\Omega$ ,  $R_{se} = 0.025\Omega$  dan  $R_{sh} = 100\Omega$ .*

[5 marks]

[5 markah]

CLO2  
C3

- (b) Calculate the generated e.m.f. of a 25kW, 250V, D.C. shunt generator which has an armature and field resistance of  $0.06\Omega$  and  $100\Omega$  respectively.

*Kirakan d.g.e. yang terjana bagi sebuah penjana medan pirau A.T. 25kW, 250V, yang mempunyai rintangan angker dan medan pirau masing-masing  $0.06\Omega$  dan  $100\Omega$ .*

[8 marks]

[8 markah]

CLO2  
C3

- (c) A shunt generator supplies 96A at a terminal voltage of 200V. The armature and shunt field resistance are  $0.1\Omega$  and  $50\Omega$  respectively. The iron and frictional losses are 2500W. Calculate:

*Penjana pirau membekalkan 96A pada sebuah voltan terminal 200V. Rintangan angker dan pirau masing-masing ialah  $0.1\Omega$  dan  $50\Omega$ . Kehilangan besi dan geseran adalah 2500W. Kirakan:*

- i. generated e.m.f. / *d.g.e. terjana.*

[4 marks]

[4 markah]

- ii. copper losses. / *kehilangan kuprum.*

[3 marks]

[3 markah]

- iii. efficiency. / *kecekapan.*

[5 marks]

[5 markah]

## QUESTION 2

## SOALAN 2

CLO2  
C2

- (a) Calculate the speed of a 6-pole D.C. motor lap-connected with 40 slots, 20 conductors per slot which has a 300V supply. It has an armature current of 30A and armature resistance of  $0.8\Omega$ . Given  $\phi = 25mWb$ .

*Kirakan kelajuan bagi sebuah motor A.T. 6-kutub sambungan-tindih dengan 40 alur, 20 pengalir per alur yang mempunyai bekalan 300V. Ia mempunyai arus anker 30A dan rintangan anker  $0.8\Omega$ . Diberi  $\phi = 25mWb$ .*

[5 marks]

[5 markah]

CLO2  
C3

- (b) A 6-pole lap wound shunt motor has 500 conductors. The armature and shunt field resistance are  $0.05\Omega$  and  $25\Omega$  respectively. Calculate the speed of the motor if it takes 120A from a D.C. supply of 100V. Flux per pole is 20mWb.

*Sebuah motor pirau 6-kutub belitan tindih mempunyai 500 bilangan pengalir. Rintangan bagi anker dan medan pirau masing-masing ialah  $0.05\Omega$  dan  $25\Omega$ . Kirakan kelajuan motor jika ia mengambil 120A daripada bekalan A.T. iaitu 100V. Nilai fluks per kutub ialah 20mWb.*

[8 marks]

[8 markah]

CLO2  
C3

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

*Sebuah motor pirau berputar pada 600p.s.m mengambil 80A di 250V. Rintangan anker dan medan pirau masing-masing ialah  $0.1\Omega$  dan  $50\Omega$ . Kehilangan besi dan geseran adalah sebanyak 2188W. Kirakan:*

- i. armature torque. / daya kilas anker.

[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) An 8-pole alternator is running at 3600r.p.m. Calculate the frequency for the alternator.  
*Sebuah alternator 8-kutub berputar pada kelajuan 3600p.s.m. Kirakan frekuensi bagi alternator tersebut.*

[5 marks]

[5 markah]

CLO2  
C3

- (b) A 3-phase, 60Hz induction motor has 4 poles. Calculate:  
*Sebuah motor aruhan 3-fasa, 60Hz mempunyai 4 kutub. Kirakan:*

- i. the synchronous speed.  
*kelajuan segerak.*

[2 marks]

[2 markah]

- ii. the speed of the motor when slip is 5%.  
*kelajuan motor apabila gelinciran adalah 5%.*

[2 marks]

[2 markah]

- iii. the rotor current frequency when motor runs at 1000r.p.m.  
*frekuensi arus pemutar apabila motor berputar pada kelajuan 1000p.s.m.*

[4 marks]

[4 markah]



CLO2  
C3

(c) A single-phase transformer is rated at 40kVA. The transformer has full-load copper losses of 800W and iron losses of 500W. Calculate the transformer efficiency at:  
*Sebuah pengubah satu-fasa dikadarkan pada 40kVA. Kehilangan kuprum pada beban penuh adalah 800W dan kehilangan besi adalah 500W. Kirakan kecekapan pengubah pada:*

i. full load, 0.8 power factor

*beban penuh, faktor kuasa 0.8.*

[6 marks]

[6 markah]

ii. half full-load, 0.8 power factor

*beban separa penuh, faktor kuasa 0.8*

[6 marks]

[6 markah]

## QUESTION 4

## SOALAN 4

CLO2  
C2

- (a) A 6600/110V step-down single-phase transformer has 3300 turns in primary. Calculate the secondary turns.

*Sebuah pengubah langkah-turun fasa-tunggal 6600/110V mempunyai 3300 lilitan primer. Kirakan bilangan lilitan sekunder.*

[5 marks]

[5 markah]

CLO2  
C3

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

*Sebuah pengubah fasa-tunggal 250kVA, 1100/400V, 50Hz mempunyai 80 lilitan pada belitan sekunder. Kirakan:*

- i. the currents flowing through the two windings  
*arus yang mengalir melalui kedua-dua belitan*

[4 marks]

[4 markah]

- ii. the primary turns / *bilangan belitan primer*

[2 marks]

[2 markah]

- iii. the maximum value of flux / *nilai fluks maksimum*

[2 marks]

[2 markah]

CLO2  
C3

- (c) In a 100kVA transformer, the iron losses is 1.2kW and its efficiency at full-load is 96.16%. If the load power factor is 0.8, calculate the copper loss at full-load and half-load efficiency.

*Pada 100kVA pengubah, kehilangan besi ialah 1.2kW dan kecekapan pada beban penuh ialah 96.16%. Jika faktor kuasa beban ialah 0.8, kirakan nilai kehilangan kuprum pada beban penuh dan kecekapan pada beban separa penuh.*

[12 marks]

[12 markah]

## 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

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

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

$$V_T = E_g - I_a R_a$$

$$P_a = E_g I_a$$

$$P_L = VI_L$$

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

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

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

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

$$F = BLI$$

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

Shunt wound motor

$$E_b = V - I_a R_a$$

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

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

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

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

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

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

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

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

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

AC motor

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

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

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

$$f_r = sf$$

Transformer

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

$$E = 4.44 f N \phi_m$$

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

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