KEMENTERIAN PENDIDIKAN TINGGI
JABATAN PENDIDIKAN POLITEKNIK DAN KOLEJ KOMUNITI

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

JABATAN KEJURUTERAAN MEKANIKAL

PEPERIKSAAN AKHIR

SESI I : 2026/2027

DJJ20263: ELECTRICAL AND ELECTRONIC TECHNOLOGY

TARIKH : 01 NOVEMBER 2026
MASA : 08.30 PAGI – 10.30 PAGI (2 JAM)

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

Struktur (4 soalan)

Dokumen sokongan yang disertakan : Formula

JANGAN BUKA KERTAS SOALAN INI SEHINGGA DIARAHKAN

(CLO yang tertera hanya sebagai rujukan)

TERBUKA

INSTRUCTIONS:

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

ARAHAN:

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

QUESTION 1

SOALAN 1

CLO1 (a) Electronic components are fundamental building blocks used in the design of electrical technology circuits. Give the standard schematic symbols for the Switch (Closed), Capacitor, Fuse and Resistor.

Komponen elektronik ialah blok binaan asas yang digunakan dalam reka bentuk litar teknologi elektrik. Berikan simbol skematik piawai bagi komponen Suis Tertutup, Kapasitor, Fius dan Perintang.

[4 marks]

[*4 markah*]

CLO1 (b) Electrical power transmission in the National Grid Network is heavily dependent on the physical properties of its overhead conductors. Explain the primary difference between a single-phase supply and a three-phase supply system in terms of voltage delivery levels and their application environments (domestic versus industrial).

Penghantaran kuasa elektrik dalam Rangkaian Grid Nasional sangat bergantung pada sifat fizikal atas konduktor .Terangkan perbezaan utama antara bekalan fasa tunggal dan sistem bekalan tiga fasa dari segi tahap penghantaran voltan serta penggunaannya (domestik berbanding industri).

TERBUKA

[6 marks]

[*6 markah*]

CLO1

(c) A DC heater power network features the following specifications:
Satu rangkaian kuasa pemanas arus terus (DC) mempunyai spesifikasi berikut:

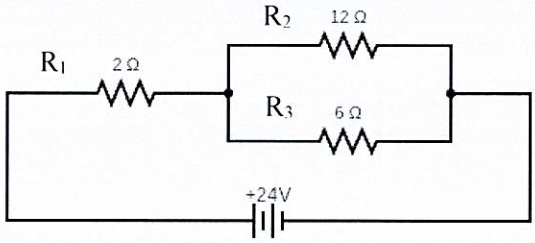

Figure 1(c) / *Rajah 1 (c)*

Circuit configuration: R_1 is connected in series with parallel combination of R_2 and R_3, calculate:
Konfigurasi litar: R_1 disambungkan secara sesiri dengan gabungan selari R_2 dan R_3.

i. The total current (I_T) drawn from the source.
Hitung jumlah arus (I_T) yang diambil daripada sumber.

[6 marks]
[*6 markah*]

ii. The current through R_2 and R_3.
Hitung arus yang melalui R_2 dan R_3.

[6 marks]
[*6 markah*]

iii. The electrical power (P_3) dissipated by resistor R_3 in Watts.
Hitung kuasa elektrik (P_3) yang dilesapkan oleh perintang R_3 dalam unit Watt.

TERBUKA

[3 marks]
[*3 markah*]

QUESTION 2

SOALAN 2

CLO1 (a) Magnetic fields and electric charges are fundamental concepts in electrical technology. State the **TWO (2)** difference between a permanent magnet and a temporary magnet.

*Medan magnet dan cas elektrik merupakan konsep asas dalam teknologi elektrik. Nyatakan **DUA (2)** perbezaan utama antara magnet kekal dengan magnet sementara.*

[4 marks]

[*4 markah*]

CLO1 (b) The passage of electrical current through conductors generates localized magnetic fields, a principle widely exploited in electrical machinery. When current flows through a single straight conductor, a circular magnetic flux is established around it.

Pengaliran arus elektrik melalui konduktor menghasilkan medan magnet setempat, suatu prinsip yang digunakan secara meluas dalam jentera elektrik. Apabila arus mengalir melalui satu konduktor lurus, fluks magnet membulat terbentuk di sekelilingnya.

i. Explain how the direction of this magnetic flux changes if the current flow direction through the conductor is completely reversed.

Terangkan bagaimana arah fluks magnet ini berubah jika arah aliran arus melalui konduktor diterbalikkan sepenuhnya.

TERBUKA

[4 marks]

[*4 markah*]

ii. Explain the difference in the resulting magnetic flux patterns and the mechanical forces generated between them if the currents in both conductors' flow in the same and opposite directions.
Terangkan perbezaan pada corak fluks magnet yang terhasil dan daya mekanik yang dijana antara kedua-dua konduktor tersebut sekiranya arus mengalir dalam arah yang sama dan arah yang bertentangan.

[4 marks]
[*4 markah*]

CLO1 (c) A circuit consists of a capacitive filter bank and a step-down transformer with the following parameters:
Satu litar terdiri daripada bank penapis kapasitif dan transformer penurun voltan dengan parameter berikut:

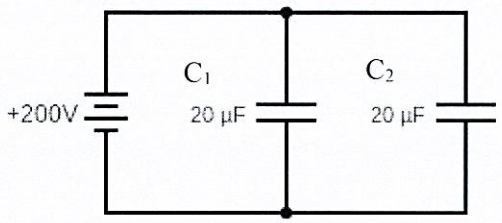

Figure 2c (i) / *Rajah 2c(i)*

i. Calculate the total equivalent capacitance (C_T) of the filter bank, and the total energy (E_C) stored in Joules (J).
Hitung jumlah kemuatan setara (C_T) bagi bank penapis dan jumlah tenaga (E_C) yang disimpan dalam unit Joule (J).

TERBUKA

[6 marks]
[*6 markah*]

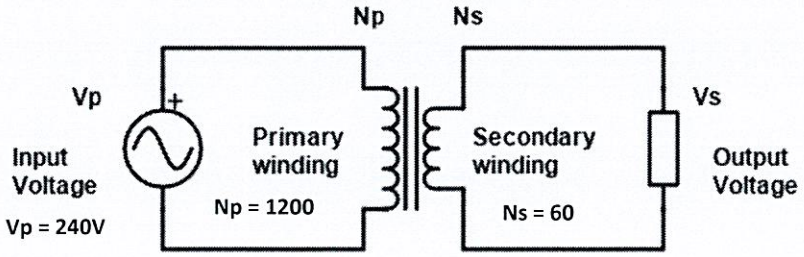

Figure 2c (ii) / *Rajah 2c (ii)*

ii. Base on given Figure 2c (ii), calculate the transformer turns ratio and determine the secondary output voltage (V_S) delivered to the load.
Berdasarkan Rajah 2c (ii), hitung nisbah lilitan transformer dan tentukan voltan keluaran sekunder (V_S) yang dibekalkan kepada beban.

[7 marks]
[*7 markah*]

TERBUKA

QUESTION 3

SOALAN 3

CLO1 (a) Electrical machines are categorized into generators and various types of motors depending on their operational design and function. Define direct current generator and alternating current generator.

Mesin elektrik dikategorikan kepada penjana dan pelbagai jenis motor bergantung kepada reka bentuk operasi dan fungsinya. Takrifkan penjana arus terus dan penjana arus ulang alik.

[4 marks]

[*4 markah*]

CLO1 (b) Explain how Fleming's Right-Hand Rule and Fleming's Left-Hand Rule are used to identify the specific direction of parameters in generators and motors.

Terangkan bagaimana Petua Tangan Kanan Fleming dan Petua Tangan Kiri Fleming digunakan untuk mengenal pasti arah khusus parameter dalam penjana dan motor.

[6 marks]

[*6 markah*]

CLO1 (c) A 3-phase AC induction motor has the following specifications:

Stator supply frequency (f) : 50Hz

Number of poles (P) : 4 poles

Rotor speed (Nr) : 1440 rpm

Sebuah motor aruhan AC 3-fasa mempunyai spesifikasi berikut:

Frekuensi bekalan stator (f) : 50Hz

Bilangan kutub (P) : 4 kutub

Kelajuan rotor (Nr) : 1440 rpm

TERBUKA

i. Calculate the synchronous speed (N_s) in rpm, and the percentage slip (%s) of the motor.
Hitung kelajuan segerak (N_s) dalam rpm dan peratusan gelinciran (%s) motor tersebut.

[6 marks]
[*6 markah*]

ii. Calculate the frequency of the rotor current (f_r) under these operating conditions
Hitung frekuensi arus pemutar (f_r) di bawah keadaan operasi ini.

[3 marks]
[*3 markah*]

iii. If the motor load changes and causes the percentage slip to increase to exactly 5%, calculate the new rotor speed (N_r) in rpm, and the new rotor frequency (f_r).
Jika beban motor berubah dan menyebabkan peratusan gelinciran meningkat kepada tepat 5%, hitung kelajuan rotor baharu (N_r) dalam rpm dan frekuensi rotor baharu (f_r).

TERBUKA

[6 marks]
[*6 markah*]

QUESTION 4

SOALAN 4

CLO1 (a) Logic circuits and specialized drawing formats are key tools used to implement electronic control systems. State AND gate using truth tables.

Litar logik dan format lukisan khusus merupakan alat utama yang digunakan untuk melaksanakan sistem kawalan elektronik. Nyatakan get DAN menggunakan jadual kebenaran.

[4 marks]

[*4 markah*]

CLO1 (b) Industrial automation relies on embedded devices and distinct memory structures to execute system control instructions efficiently.

Automasi industri bergantung pada peranti terbenam dan struktur memori khusus untuk melaksanakan arahan kawalan sistem dengan cekap.

i. A computer or controller utilizes different memory architectures to handle instructions and temporary information. Explain how RAM and ROM are different, focusing on what happens to their saved data when the power is turned off and how each is used in a system.

Sesebuah komputer atau pengawal menggunakan seni bina memori yang berbeza untuk mengendalikan arahan dan maklumat sementara. Terangkan perbezaan antara ***Random Access Memory (RAM)*** *dan* ***Read-Only Memory (ROM)*** *dengan menumpukan kepada apa yang berlaku terhadap data yang disimpan apabila bekalan kuasa dimatikan serta cara setiap satunya digunakan dalam sesuatu sistem.*

TERBUKA

[4 marks]

[*4 markah*]

ii. Microprocessors, Microcontrollers, and Programmable Logic Controllers (PLCs) are core hardware components used in electrical technology control systems. Explain how a microcontroller is different from a microprocessor in terms of their built-in parts and where they are normally used.

Mikropemproses, Mikropengawal, dan Pengawal Logik Bolehaturcara (PLC) merupakan komponen perkakasan teras yang digunakan dalam sistem kawalan teknologi elektrik. Jelaskan perbezaan antara mikropengawal dengan mikropemproses dari segi komponen terbina dalamnya dan kegunaan biasa.

[4 marks]

[*4 markah*]

CLO1 (c) Figure 4 (c) (i) shows the digital logic circuit consisting of two inputs A and B, and combination of logic gates.

Rajah 4 (c) (i) menunjukkan litar logic digital yang terdiri daripada dua input A dan B dan gabungan get logik.

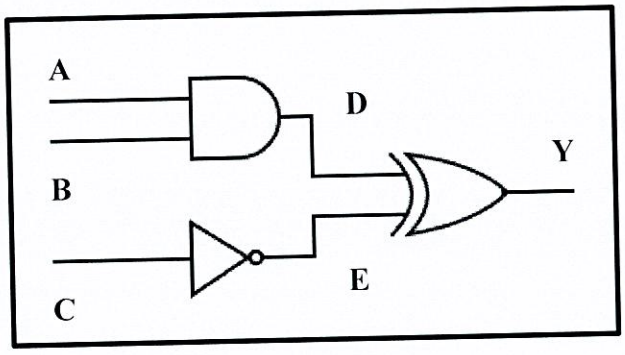

Figure 4c(i) / Rajah 4c(i)

TERBUKA

i. Complete the truth table below for the logic circuit in Figure 4c (i)

Lengkapkan jadual kebenaran di bawah untuk litar logic dalam rajah 4c(i)

A	B	C	D	E	Y
0	0	0	0	1	
0	0	1	0	0	0
0	1	0			1
0	1	1	0	0	0
1	0	0		1	
1	0	1	0	0	0
1	1	0		1	0
1	1	1	1	0	1

[3 marks]

[*3 markah*]

ii. Draw the logic circuit for the following Boolen expressions:

$Y = \bar{A}B + \bar{O}$

Lukiskan litar logic bagi ungkapan Boolen berikut:

[10 marks]

[*10 markah*]

TERBUKA

SOALAN TAMAT

DJJ20263 – ELECTRICAL AND ELECTRONIC TECHNOLOGY

FORMULA

Introduction to Electrical and Electronic

$V = IR \qquad P = IV \qquad E = Pt \qquad Q = CV$

Series Circuit

$$R_T = R_1 + R_2 + R_3 + \cdots R_n$$

$$V_T = V_1 + V_2 + V_3 + \cdots V_n$$

$$I_T = I_1 = I_2 = I_3 = \cdots = I_n$$

Voltage Divider Law

$$V_X = \left(\frac{R_X}{R_T}\right) V_T$$

Parallel Circuit

$$\frac{1}{R_T} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} + \cdots \frac{1}{R_n} \quad \text{or}$$

$$R_T = \frac{R_1 R_2 R_3}{R_2 R_3 + R_1 R_3 + R_1 R_2}$$

$$V_T = V_1 = V_2 = I_3 = \cdots = V_n$$

$$I_T = I_1 + I_2 + I_3 + \cdots I_n$$

Current Divider Law

$$I_x = \left(\frac{R_T}{R_X}\right) I_T$$

Electromagnetism and Electrostatic

Electromagnetism

$\Phi = B\,x\,A \qquad B = \frac{\Phi}{A} \qquad B = \mu H$

$F_M = NI \qquad H = \frac{F_M}{l}$

$\mu = \mu_0\,\mu_r \qquad \mu = \frac{B}{H} \qquad \mu_0\,\mu_r = \frac{B}{H}$

$S = \frac{F_M}{\Phi} \qquad S = \frac{l}{\mu H} \qquad S = \frac{l}{\mu_0\,\mu_r A}$

Transformer

$$\frac{V_P}{V_S} = \frac{N_P}{N_S} = \frac{I_S}{I_P}$$

$E_P = 4.44 f N_P \Phi \qquad E_S = 4.44 f N_S \Phi$

Inductor

$$E = \frac{1}{2} LI^2$$

Series inductor

$$L_T = L_1 + L_2 + L_3 + \cdots L_n$$

Parallel inductor

$$\frac{1}{L_T} = \frac{1}{L_1} + \frac{1}{L_2} + \frac{1}{L_3} + \cdots \frac{1}{L_n}$$

Capacitor

$$E = \frac{1}{2} QV$$

Series capacitor

$$\frac{1}{C_T} = \frac{1}{C_1} + \frac{1}{C_2} + \frac{1}{C_3} + \cdots \frac{1}{C_n}$$

Parallel capacitor

$$C_T = C_1 + C_2 + C_3 + \cdots C_n$$

Motor and Generator

$N_S = \frac{120f}{P} \qquad N_r = N_S\,(1 - S)$

$S = \frac{N_S - N_r}{N_S} \qquad \%S = \frac{N_S - N_r}{N_S}\ x\ 100\%$

$f_r = S\,x\,f$

$f = f_r + f_S$

Automation Control System

Boolean Expression

AND Gate: Y=A·B (A AND B)

OR Gate: Y=A+B (A OR B)

NOT Gate: Y=A (NOT A)

NAND Gate: Y=A·B (NOT (A AND B))

NOR Gate: Y=A+B (NOT (A OR B))

XOR Gate: Y=A⊕B (A XOR B)

XNOR Gate: Y=A⊕B (NOT (A XOR B))

TERBUKA