SULIT

KEMENTERIAN PENDIDIKAN TINGGI
JABATAN PENDIDIKAN POLITEKNIK DAN KOLEJ KOMUNITI

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

JABATAN MATEMATIK, SAINS & KOMPUTER

PEPERIKSAAN AKHIR

SESI II : 2023/2024

DBM10013 : ENGINEERING MATHEMATICS 1

TARIKH : 25 MEI 2024
MASA : 11.30 PAGI - 1.30 PETANG (2 JAM)

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

Struktur (4 soalan)

Dokumen sokongan yang disertakan : Kertas Graf dan Formula

JANGAN BUKA KERTAS SOALAN INI SEHINGGA DIARAHKAN

(CLO yang tertera hanya sebagai rujukan)

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

ARAHAN:
*Bahagian ini mengandungi **EMPAT (4)** soalan struktur. Jawab **SEMUA** soalan.*

QUESTION 1

SOALAN 1

CLO1 (a) Simplify the following expressions to the lowest term.

Permudahkan ungkapan yang berikut kepada sebutan terendah.

i. $\dfrac{x^2-16}{3x-12} \div (x^2+4x)$

[3 marks]

[*3 markah*]

ii. $\dfrac{3x+3}{x^2-1} - \dfrac{5}{x-1}$

[4 marks]

[*4 markah*]

CLO1 (b) Solve the following quadratic equation by completing the square.

Selesaikan persamaan kuadratik berikut dengan penyempurnaan kuasa dua.

$$x^2 - 2x - 3 = 0$$

[5 marks]

[*5 markah*]

CLO2 (c) Solve the following partial fractions.

Selesaikan pecahan separa berikut.

i. $\frac{2x}{(x^2-4)}$

[5 marks]

[*5 markah*]

ii. $\frac{3x-1}{x^2(x-1)}$

[8 marks]

[*8 markah*]

QUESTION 2

SOALAN 2

CLO1 (a) Calculate the complex numbers below in the form of $a + bi$.

Kira nombor kompleks di bawah dalam bentuk $a + bi$.

i. $(5 + i) - 2(-2 - 7i)$

[3 marks]

[*3 markah*]

ii. $\dfrac{4 + 3i}{-2 - 7i}$

[5 marks]

[*5 markah*]

CLO1 (b) Calculate the modulus, argument and sketch the Argand Diagram for $-10 - 5i$.

Hitung modulus, hujah dan lakarkan Rajah Argand untuk $-10 - 5i$.

[7 marks]

[*7 markah*]

(c)

CLO2 i. Solve the following expression in an exponential form.

Selesaikan ungkapan berikut dalam bentuk eksponen.

$$\frac{45\,(\cos 270° + i \sin 270°) \times 5\,(\cos 50° + i \sin 50°)}{15\,(\cos 110° + i \sin 110°)}$$

[6 marks]

[*6 markah*]

ii. Given that $Z_1 = 4\angle 125°$ and $Z_2 = 40\,(\cos 25° + i \sin 25°)$. Solve the $Z_2 \times Z_1$ in polar form.

Diberi $Z_1 = 4\angle 125°$ *dan* $Z_2 = 40\,(\cos 25° + i \sin 25°)$. *Selesaikan* $Z_2 \times Z_1$ *dalam bentuk polar.*

[4 marks]

[*4 markah*]

QUESTION 3

SOALAN 3

CLO1

(a) Given matrix $Z = \begin{bmatrix} 1 & 0 & 2 \\ 3 & 1 & 4 \\ 2 & 7 & 6 \end{bmatrix}$.

Diberi matriks $Z = \begin{bmatrix} 1 & 0 & 2 \\ 3 & 1 & 4 \\ 2 & 7 & 6 \end{bmatrix}$.

i. Identify the element of Z_{12}, Z_{23}, Z_{32}.

Kenalpasti unsur-unsur Z_{12}, Z_{23}, Z_{32}.

[3 marks]

[*3 markah*]

ii. Express Z^T.

Nyatakan Z^T.

[1 mark]

[*1 markah*]

CLO1

(b) Given that matrix $A = \begin{bmatrix} 1 & 2 & 2 \\ 0 & 5 & 3 \\ -1 & 4 & 6 \end{bmatrix}$ and $B = \begin{bmatrix} 2 & 1 & 3 \\ 5 & 2 & 2 \\ 3 & 4 & 1 \end{bmatrix}$, calculate:

Diberi matriks $A = \begin{bmatrix} 1 & 2 & 2 \\ 0 & 5 & 3 \\ -1 & 4 & 6 \end{bmatrix}$ *dan* $B = \begin{bmatrix} 2 & 1 & 3 \\ 5 & 2 & 2 \\ 3 & 4 & 1 \end{bmatrix}$, *hitung:*

i. $A^T + 3B$.

[6 marks]

[*6 markah*]

ii. Determinant A.

[4 marks]

[*4 markah*]

CLO2 (c) Calculate the values of a, b and c for the following equation by using Inverse Matrix Method.

Kira nilai a, b dan c bagi persamaaan berikut dengan menggunakan Kaedah Matrik Songsang.

$$2a + b - 2c = 3$$
$$3a - 2b - 4c = 10$$
$$a + b + 4c = -2$$

[11 marks]

[*11 markah*]

QUESTION 4

SOALAN 4

CLO1 (a) Given that $\vec{K} = 3i + 2j - 4k$, $\vec{L} = 5i - 3j + 7k$ and $\vec{M} = -i + 7j - 3k$. Write each of the following in the term of i, j and k.

Diberi $\vec{K} = 3i + 2j - 4k$, $\vec{L} = 5i - 3j + 7k$ *dan* $\vec{M} = -i + 7j - 3k$. *Tulis setiap yang berikut dalam bentuk* i, j dan k.

i. $\vec{K} + \vec{M}$.

[2 marks]

[*2 markah*]

ii. $-2\vec{L} - \vec{M}$.

[2 marks]

[*2 markah*]

iii. Vector unit for $\vec{L}$.

[3 marks]

[*3 markah*]

(b) Given that vector $\vec{s} = 5i + 3j$, $\vec{t} = -2i - 4j$ and $\vec{u} = 3i + 7j$.

CLO1 *Diberi vektor* $\vec{s} = 5i + 3j$, $\vec{t} = -2i - 4j$ *dan* $\vec{u} = 3i + 7j$.

i. Compute $2\vec{s} + 3\vec{t} - 5\vec{u}$ in term of i and j.

Hitung $2\vec{s} + 3\vec{t} - 5\vec{u}$ dalam sebutan of i dan j.

[3 marks]

[*3 markah*]

ii. Find $\vec{s} + \vec{u}$ by using the Parallelogram method on a graph paper.

Cari $\vec{s} + \vec{u}$ *menggunakan kaedah Segiempat Selari di atas kertas graf.*

[5 marks]

[*5 markah*]

CLO2

(c) Given that $\vec{A} = 6i + 2j - 3k$, $\vec{B} = -2i - 7j + 3k$ and $\vec{C} = -5i + 3j - 5k$. Calculate:

Diberi $\vec{A} = 6i + 2j - 3k$, $\vec{B} = -2i - 7j + 3k$ *dan* $\vec{C} = -5i + 3j - 5k$. *Kira:*

i. Vector $\overrightarrow{AB}$ and $\overrightarrow{AC}$.

Vektor $\overrightarrow{AB}$ *dan* $\overrightarrow{AC}$.

[4 marks]

[*4 markah*]

ii. $\overrightarrow{AB} \times \overrightarrow{AC}$.

[4 marks]

[*4 markah*]

iii. Area of parallelogram.

Luas segiempat selari.

[2 marks]

[2 *markah*]

SOALAN TAMAT

FORMULA SHEET FOR ENGINEERING MATHEMATICS (DBM10013)

QUADRATIC EQUATION

1. ***Quadratic formula,*** $x = \frac{-b \pm \sqrt{b^2-4ac}}{2a}$
2. ***Completing the square,***

$$\left(x+\frac{b}{2}\right)^2 - \left(\frac{b}{2}\right)^2 + c = 0$$

FORMULA OF TRIANGLE

1. ***Sine Rules;*** $\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$
2. ***Cosine Rules;*** $\mathbf{a^2 = b^2 + c^2 - 2bc\cos A}$
3. ***Area of Triangle*** $= \frac{1}{2}ab\sin C$

MATRIX

1. ***Cofactor;*** $C = (-1)^{i+j}M_{ij}$
2. ***Adjoin;*** $Adj(A) = C^T$
3. ***Inverse of Matrix;*** $A^{-1} = \frac{1}{|A|}Adj(A)$
4. ***Cramer's Rule;***

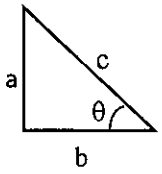
$$x = \frac{|A_1|}{|A|}, \quad y = \frac{|A_2|}{|A|}, \quad z = \frac{|A_3|}{|A|}$$

COMPLEX NUMBER

1. ***Modulus of*** $z = \sqrt{a^2+b^2}$
2. ***Argument of*** $z = tan^{-1}\left(\frac{b}{a}\right)$
3. ***Cartesian Form;*** $z = a + bi$
4. ***Polar Form;*** $z = r \angle \theta$
5. ***Exponential Form;*** $z = re^{i\theta}$
6. ***Trigonometric Form;*** $z = r\,(\cos\theta + \mathrm{i}\sin\theta)$

TRIGONOMETRY

Pythagoras' Theorem



$$c^2 = a^2 + b^2$$

Trigonometric Identities

$$\tan\theta = \frac{\sin\theta}{\cos\theta}$$

$$cos^2\theta + sin^2\theta = 1$$

$$1 + tan^2\theta = sec^2\theta$$

$$1 + cot^2\theta = cosec^2\theta$$

VECTOR & SCALAR

1. ***Unit Vector;*** $\hat{u} = \frac{\bar{u}}{|u|}$
2. ***Cos θ*** $= \frac{\bar{A} \bullet \bar{B}}{|A||B|}$
3. ***Scalar Product;***

$$\vec{A} \bullet \vec{B} = a_1a_2 + b_1b_2 + c_1c_2$$

4. ***Vector Product;***

$$\vec{A} \times \vec{B} = \begin{vmatrix} i & j & k \\ a_1 & b_1 & c_1 \\ a_2 & b_2 & c_2 \end{vmatrix}$$

5. ***Area of parallelogram ABC;***

$$\left|\overrightarrow{AB} \times \overrightarrow{BC}\right|$$

COMPOUND-ANGLE

1. $\sin(A \pm B) = \sin A\cos B \pm \cos A\sin B$
2. $\cos(A \pm B) = \cos A\cos B \mp \sin A\sin B$
3. $\tan(A \pm B) = \frac{tan\ A \pm tan\ B}{1 \mp \tan A\tan B}$

DOUBLE-ANGLE

1. $\sin 2A = 2\sin A\cos A$
2. $\cos 2A = cos^2A - sin^2A$

$$= 1 - 2sin^2A$$

$$= 2cos^2A - 1$$

3. $\tan 2A = \frac{2\tan A}{1-tan^2A}$