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

[5 marks]

[*5 markah*]

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

[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*]

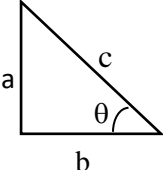   iii.   Area of parallelogram.

       Luas segiempat selari.

[2 marks]

[2 *markah*]

SOALAN TAMAT

FORMULA SHEET FOR ENGINEERING MATHEMATICS (DBM10013)

QUADRATIC EQUATION

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

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;** $\dfrac{a}{\sin A} = \dfrac{b}{\sin B} = \dfrac{c}{\sin C}$

2. **Cosine Rules;** $a^2 = b^2 + c^2 - 2bc \cos A$

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;** $A^{-1} = \dfrac{1}{|A|} Adj(A)$

4. **Cramer's Rule;**

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

COMPLEX NUMBER

1. **Modulus of** $z = \sqrt{a^2 + b^2}$

2. **Argument of** $z = tan^{-1}\left(\dfrac{b}{a}\right)$

3. **Cartesian Form;** $z = a + bi$

4. **Polar Form;** $z = r \angle \theta$

5. **Exponential Form;** $z = re^{i\theta}$

6. **Trigonometric Form;** $z = r(\cos\theta + i\sin\theta)$

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;** $\hat{u} = \dfrac{\bar{u}}{|u|}$

2. **Cos θ** $= \dfrac{\bar{A} \bullet \bar{B}}{|A||B|}$

3. **Scalar Product;**

$$\vec{A} \bullet \vec{B} = a_1 a_2 + b_1 b_2 + c_1 c_2$$

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. $\tan(A \pm B) = \dfrac{\tan A \pm \tan B}{1 \mp \tan A \tan B}$

DOUBLE-ANGLE

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

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

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

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

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