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 DAN KOMPUTER

PEPERIKSAAN AKHIR

SESI I : 2023/2024

DBM10013: ENGINEERING MATHEMATICS 1

TARIKH : 27 DISEMBER 2023
MASA : 8.30 AM – 10.30 AM (2 JAM)

Kertas ini mengandungi **SEMBILAN (9)** 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 berstruktur. Jawab **SEMUA** soalan.*

QUESTION 1

SOALAN 1

CLO1   (a)   Express each of the following expression in the simplest form:

Ungkapkan yang berikut dalam bentuk yang termudah:

     i. $3h(6h - 3) - 2(h^2 - 7)$

[3 marks]

[*3 markah*]

     ii. $\dfrac{5(3x - 2)}{3x^2 - 11x + 6} \div \dfrac{2x}{x - 3}$

[4 marks]

[*4 markah*]

CLO1   (b)   Solve the quadratic equation below by using Completing the Square Method. Give your answer in 3 decimal places.

Selesaikan persamaan kuadratik berikut menggunakan Kaedah Penyempurnaan Kuasa Dua. Beri jawapan dalam 3 titik perpuluhan.

$$2n^2 - 4n - 3 = 0$$

[5 marks]

[*5 markah*]

CLO2

(c)   Solve each of the following partial fraction:

Selesaikan setiap pecahan separa berikut:

i. $\dfrac{5-x}{(2x-3)(x-2)}$

[5 marks]

[5 *markah*]

ii. $\dfrac{4x^2}{(x-1)(x^2+1)}$

[8 marks]

[8 *markah*]

QUESTION 2

SOALAN 2

CLO1

(a) Determine each of the following complex number in the form of $a + bi$.

Selesaikan setiap nombor kompleks berikut dalam bentuk $a + bi$.

i. $3[(2i - 1) - (-1 + 5i)]$

[3 marks]

[3 *markah*]

ii. $\dfrac{4 - 2i}{-2 - 6i}$

[5 marks]

[5 *markah*]

CLO1

(b) Given that $M = -27 - 9i$ and $N = -3i$. Calculate the value of $\dfrac{M}{N}$ by using conjugate. Hence, find the modulus, argument and sketch the Argand diagram of $\dfrac{M}{N}$.

Diberi $M = -27 - 9i$ dan $N = -3i$. Kirakan nilai bagi $\dfrac{M}{N}$ dengan menggunakan konjugat. Seterusnya, cari modulus, argumen dan lakarkan gambarajah Argand bagi $\dfrac{M}{N}$.

[7 marks]

[7 *markah*]

CLO2   (c)   Given that $Z_1 = 36(\cos 180^o + i \sin 180^o)$, $Z_2 = 9 \angle 123^o$ and

$Z_3 = 7e^{1.0472\,i}$. Calculate:

Diberi $Z_1 = 36(cos\,180^o + i\,sin\,180^o)$, $Z_2 = 9 \angle 123^o$ *dan*

$Z_3 = 7e^{1.0472\,i}$. *Hitung:*

     i. $\dfrac{Z_2}{Z_1}$ in Trigonometric Form.

          $\dfrac{Z_2}{Z_1}$ *dalam Bentuk Trigonometri.*

[3 marks]

[3 *markah*]

     ii. $Z_1 - Z_3$ in Cartesian Form.

          $Z_1 - Z_3$ *dalam Bentuk Cartesian.*

[7 marks]

[7 *markah*]

QUESTION 3
SOALAN 3

CLO1

(a)   Referring to matrix $P = \begin{bmatrix} 2 & 0 & 6 \\ 4 & 7 & 8 \\ -3 & 5 & 1 \end{bmatrix}$,

       Berdasarkan matriks $P = \begin{bmatrix} 2 & 0 & 6 \\ 4 & 7 & 8 \\ -3 & 5 & 1 \end{bmatrix}$,

       i.   Identify the element at P_{23}

              Tentukan unsur pada P_{23}

                                                   [1 mark]

                                                  [1 *markah*]

       ii.   Express $3P^T$

              Ungkapkan $3P^T$

                                                    [3 marks]

                                                  [3 *markah*]

CLO1

(b)   Given matrix $A = \begin{bmatrix} 2 & 3 & 3 \\ 1 & -2 & 1 \end{bmatrix}$, $B = \begin{bmatrix} 1 & 1 \\ 3 & -4 \\ 2 & 5 \end{bmatrix}$ and $C = \begin{bmatrix} -2 & -4 & 7 \\ 3 & 5 & 3 \end{bmatrix}$,

       calculate:

       Diberi matriks $A = \begin{bmatrix} 2 & 3 & 3 \\ 1 & -2 & 1 \end{bmatrix}$, $B = \begin{bmatrix} 1 & 1 \\ 3 & -4 \\ 2 & 5 \end{bmatrix}$ *dan* $C = \begin{bmatrix} -2 & -4 & 7 \\ 3 & 5 & 3 \end{bmatrix}$,

       hitung:

       i. $2B$

                                                    [1 mark]

                                                  [1 *markah*]

       ii. $A + B^T - C$

                                                    [4 marks]

                                                  [4 *markah*]

iii. $A^T C$

[5 marks]

[5 *markah*]

CLO2   (c)   Solve the following equations by using Inverse Method.

Selesaikan persamaan berikut dengan menggunakan Kaedah Songsangan.

$$3x - 2y = 23$$
$$x - 4y = 17$$

[11 marks]

[11 *markah*]

QUESTION 4

SOALAN 4

CLO1 (a) Given that $\vec{A} = 2i + 7j - 9k$, $\vec{B} = i + 3j - k$ and $\vec{C} = -4i - 3j + 5k$. Solve each of the following in the term of i , j and k .

Diberi $\vec{A} = 2i + 7j - 9k$, $\vec{B} = i + 3j - k$ dan $\vec{C} = -4i - 3j + 5k$. Selesaikan setiap yang berikut dalam bentuk i, j and k.

i. $\vec{A} + 2\vec{C}$

[2 marks]

[2 *markah*]

ii. $-\vec{B} - \vec{C}$

[2 marks]

[2 *markah*]

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

Unit vector bagi $\vec{B}$

[3 marks]

[3 *markah*]

CLO1 (b) Given that the position vectors $\overrightarrow{OP} = 3i - j$ and $\overrightarrow{OQ} = 2i + 9j$.

Diberi vektor-vektor posisi $\overrightarrow{OP} = 3i - j$ dan $\overrightarrow{OQ} = 2i + 9j$.

i.   Calculate $\overrightarrow{PQ}$

Kira $\overrightarrow{PQ}$

[3 marks]

[3 *markah*]

ii.   Draw $\overrightarrow{PQ}$ by using Parallelogram Method on a graph paper.

Lukis $\overrightarrow{PQ}$ menggunakan Kaedah Segiempat Selari di atas kertas graf.

[5 marks]

[5 *markah*]

CLO2

(c)   Given vectors $\vec{M} = 2i - 7j + 4k$ and $\vec{N} = 3i - 5j + k$. Calculate:

Diberi vektor $\vec{M} = 2i - 7j + 4k$ dan $\vec{N} = 3i - 5j + k$. Hitung:

i. $\vec{M} \bullet \vec{N}$

[2 marks]
[2 *markah*]

ii. $\vec{M} \times \vec{N}$

[3 marks]
[3 *markah*]

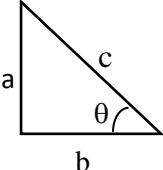iii.   the angle between two vectors $\vec{M}$ and $\vec{N}$

sudut di antara dua vektor $\vec{M}$ dan $\vec{N}$

[5 marks]
[5 *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. $\tan 2A = \dfrac{2\tan A}{1 - \tan^2 A}$