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 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. $\frac{4-2i}{-2-6i}$

[5 marks]

[5 *markah*]

CLO1 (b) Given that $M = -27 - 9i$ and $N = -3i$. Calculate the value of $\frac{M}{N}$ by using conjugate. Hence, find the modulus, argument and sketch the Argand diagram of $\frac{M}{N}$.

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

[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. $\frac{Z_2}{Z_1}$ in Trigonometric Form.

$\frac{Z_2}{Z_1}$ *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,*** $x = \frac{-b \pm \sqrt{b^2-4ac}}{2a}$
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;***

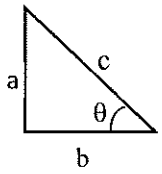
$$x = \frac{|A_1|}{|A|}, \quad y = \frac{|A_2|}{|A|}, \quad z = \frac{|A_3|}{|A|}$$

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;*** $\hat{u} = \frac{\overline{u}}{|u|}$
2. ***Cos θ*** $= \frac{\overline{A} \bullet \overline{B}}{|A||B|}$
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. $\tan 2A = \frac{2\tan A}{1 - tan^2A}$