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 II : 2022/2023

DBM10013: ENGINEERING MATHEMATICS 1

TARIKH : 8 JUN 2023
MASA : 8.30 PG - 10.30 PG (2 JAM)

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

Struktur (4 soalan)

Dokumen sokongan yang disertakan : 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 strukur. Jawab **SEMUA** soalan.*

QUESTION 1

SOALAN 1

CLO1 a) Express the following expressions in the simplest form:

Ungkapkan semula setiap sebutan berikut dalam bentuk termudah:

i. $(4a^2b - 2a) \div \frac{2ab-1}{ab}$

[3 marks]

[*3 markah*]

ii. $\frac{x^2-1}{x^2-4} \div \frac{x^2+2x+1}{x^2+4x+4}$

[4 marks]

[*4 markah*]

CLO1 b) Solve the quadratic equation below by using quadratic formula method.

Selesaikan persamaan kuadratik di bawah menggunakan kaedah formula kuadratik.

$$2x^2 - 4x + 1 = 0$$

[5 marks]

[*5 markah*]

CLO2

c) Construct the partial fraction for the following equations:

Bina pecahan separa bagi persamaan yang berikut:

i. $\frac{4-3x}{(3-x)(2-3x)}$

[5 marks]

[*5 markah*]

ii. $\frac{2x^2+1}{x^3+2x^2+x}$

[8 marks]

[*8 markah*]

QUESTION 2

SOALAN 2

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

Kirakan nombor kompleks di bawah dalam bentuk a+bi.

i. $(2 + 7i)\,(8 + 3i)$

[4 marks]

[*4 markah*]

ii. $\frac{6+7i}{8-i}$

[4 marks]

[*4 markah*]

CLO1 b) Calculate the modulus, argument and sketch the Argand Diagram for $7 - 5i$.

Kira modulus, hujah dan lakarkan Rajah Argand untuk $7 - 5i$.

[7 marks]

[*7 markah*]

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

Selesaikan ungkapan berikut dalam bentuk eksponen.

$$\frac{20\left(cos300^{\circ} + i\,sin300^{\circ}\right) \times 4(cos20^{\circ} + i\,sin20^{\circ})}{10(cos50^{\circ} + i\,sin50^{\circ})}$$

[6 marks]

[*6 markah*]

ii. Given that $Z_1 = 20(cos14^{\circ} + i\,sin14^{\circ})$ and $Z_2 = 40\angle 125^{\circ}$. Solve $\frac{Z_2}{Z_1}$ in trigonometric form.

Diberi $Z_1 = 20(cos14^{\circ} + i\,sin14^{\circ})$ *dan* $Z_2 = 40\angle 125^{\circ}$. *Selesaikan* $\frac{Z_2}{Z_1}$ *dalam bentuk trigonometrik.*

[4 marks]

[*4 markah*]

QUESTION 3

SOALAN 3

CLO1

a) Given matrix $A = \begin{bmatrix} 2 & 10 \\ 5 & 9 \\ 3 & 8 \end{bmatrix}$

Diberi matriks $A = \begin{bmatrix} 2 & 10 \\ 5 & 9 \\ 3 & 8 \end{bmatrix}$

i. Express the elements of a_{11}, a_{21} and a_{32}.

Nyatakan unsur-unsur a_{11}, a_{21} *dan* a_{32}.

[3 marks]

[*3 markah*]

ii. Convert matrix A to matrix A^T.

Tukarkan matriks A kepada matriks A^T.

[1 mark]

[*1 markah*]

CLO1

b) Given that matrix $M = \begin{bmatrix} 9 & 7 \\ 4 & 3 \end{bmatrix}$ and $N = \begin{bmatrix} 2 & 5 \\ -7 & 6 \end{bmatrix}$, calculate:

Diberi matriks $M = \begin{bmatrix} 9 & 7 \\ 4 & 3 \end{bmatrix}$ *dan* $N = \begin{bmatrix} 2 & 5 \\ -7 & 6 \end{bmatrix}$, *kira:*

i. $3M + N^T$

[6 marks]

[*6 markah*]

ii. M^{-1}

[4 marks]

[*4 markah*]

CLO2

c) Given that the following matrix has determinant of -19. Calculate the values of x, y and z for the following equation by using Inverse Matrix Method.
Diberi bahawa matrix berikut mempunyai penentu -19. Kira nilai x, y and z bagi persamaan berikut dengan menggunakan Kaedah Matrik Songsang.

$$2x - y + z = 5$$
$$x + y - 2z = 3$$
$$3x - 2y - 4z = 10$$

[11 marks]
[*11 markah*]

QUESTION 4

SOALAN 4

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

Diberi $\vec{A} = 2i + 7j - 9k$, $\vec{B} = i + 3j - k$ *dan* $\vec{C} = -4i - 3j + 5k$. *Tuliskan 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 vector $\tilde{a} = 6i + 3j$, $\tilde{b} = 2i - j$ and $\tilde{c} = 3i + j$.

Diberi vektor $\tilde{a} = 6i + 3j$, $\tilde{b} = 2i - j$ *dan* $\tilde{c} = 3i + j$.

i. Compute $2\tilde{a} + \tilde{b} - 3\tilde{c}$ in term of i and j.

Hitung $2\tilde{a} + \tilde{b} - 3\tilde{c}$ *dalam sebutan* i *dan* j.

[3 marks]

[*3 markah*]

ii. Find $\tilde{a} + \tilde{b}$ by using Parallelogram method on a graph paper. State the answer in (x, y) form.
Cari $\tilde{a} + \tilde{b}$ *dengan menggunakan kaedah Segiempat Selari di atas kertas graf. Nyatakan jawapan dalam bentuk* (x, y).

[5 marks]
[*5 markah*]

CLO2 c) Given $T = 2i + 3j - 6k$, $U = 3i - 2j - 7k$ and $V = 3i - 5j + 5k$. Calculate:
Diberi $T = 2i + 3j - 6k$, $U = 3i - 2j - 7k$ *dan* $V = 3i - 5j + 5k$. *Kira:*

i. Vector $\overrightarrow{TU}$ and $\overrightarrow{UV}$
Vector $\overrightarrow{TU}$ *dan* $\overrightarrow{UV}$

[6 marks]
[*6 markah*]

ii. $\overrightarrow{TU} \times \overrightarrow{UV}$

[3 marks]
[*3 markah*]

iii. Area of parallelogram
Luas segiempat selari

[1 mark]
[*1 markah*]

SOALAN TAMAT

FORMULA SHEET FOR ENGINEERING MATHEMATICS 1 (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;***

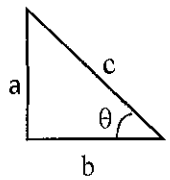
$$x = \frac{|A_1|}{|A|}, y = \frac{|A_2|}{|A|}, z = \frac{|A_3|}{|A|}$$

COMPLEX NUMBER

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

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*** $= \frac{\overline{A} \cdot \overline{B}}{|A||B|}$
3. ***Scalar Product;***

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

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

DOUBLE-ANGLE

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

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

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

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