POLITEKNIK
MALAYSIA

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

JABATAN MATEMATIK, SAINS & KOMPUTER

PEPERIKSAAN AKHIR (PALT)

SESI II : 2021/2022

DBM10013: ENGINEERING MATHEMATICS 1

TARIKH : 27 JUN 2022
MASA : 08.30 PAGI – 10.30 PAG1 (2 JAM)

Kertas ini mengandungi **SEPULUH (10)** 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 berstruktur. Jawab **SEMUA** soalan.*

QUESTION 1
SOALAN 1

CLO 1
C3

a)   Solve the following expressions in the simplest form.

Ungkapkan setiap yang berikut dalam bentuk termudah.

i. $\frac{1}{2}(4b+3a)-5(2b-a)$

[3 marks]

[*3 markah*]

ii. $\frac{12x-4x^2}{6x^2-7x+2} \div \frac{4x}{2x-1}$

[3 marks]

[*3 markah*]

CLO 1
C3

b)   Solve the equation of $3t^2-4t=7$ by using Quadratic Formula.

Selesaikan persamaan bagi $3t^2-4t=7$ dengan menggunakan Formula Kuadratik.

[7 marks]

[*7 markah*]

CLO 2
C3

c)

   i.   Calculate the value of A and B by using Partial Fraction Decomposition Method.

Kirakan nilai A dan B dengan menggunakan Kaedah Komposisi Pecahan Separa.

$$\frac{5x+13}{x^2+4x-5}=\frac{A}{(x-1)}+\frac{B}{(x+5)}$$

[5 marks]

[*5 markah*]

   ii.   Calculate the partial fraction for the following equation.

Kirakan pecahan separa bagi persamaan yang berikut.

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

[7 marks]

[*7 markah*]

QUESTION 2

SOALAN 2

CLO 1
C3

a)   i.   Given two complex numbers $Z_1 = 2 - \sqrt{3}\,i$ and $Z_2 = -5 + i$. Determine $Z_1 + 2Z_2$.

Diberi dua nombor kompleks $Z_1 = 2 - \sqrt{3}\,i$ dan $Z_2 = -5 + i$. Tentukan $Z_1 + 2Z_2$.

[3 marks]

[*3 markah*]

ii.   Solve $\dfrac{1}{\sqrt{2} + \sqrt{2}\,i}$ in the form $a + bi$.

Selesaikan $\dfrac{1}{\sqrt{2} + \sqrt{2}\,i}$ dalam bentuk $a + bi$.

[4 marks]

[*4 markah*]

CLO 1
C3

b)   Given $T = 6 - 8i$ and $U = -4 + i$.

Diberi $T = 6 - 8i$ dan $U = -4 + i$.

i.   Determine modulus and the argument of $\dfrac{T}{U}$

Tentukan modulus dan hujah bagi $\dfrac{T}{U}$

[6 marks]

[*6 markah*]

ii.   Sketch the Argand's Diagram of $\dfrac{T}{U}$.

Lakarkan Rajah Argand $\dfrac{T}{U}$.

[2 marks]

[*2 markah*]

CLO 2
C3

c)   Given $X = 13(\cos 67.38° + i \sin 67.38°)$, $Y = -4 - 2i$ and $Z = -3 + i$. Compute the following in Cartesian form.

Diberi $X = 13(\cos 67.38° + i \sin 67.38°)$, $Y = -4 - 2i$ dan $Z = -3 + i$. Kirakan yang berikut dalam bentuk Cartesan.

i. $Y - Z$

[2 marks]

[*2 markah*]

ii. $2XY$

[4 marks]

[*4 markah*]

iii. $\dfrac{1}{2Y}$

[4 marks]

[*4 markah*]

QUESTION 3

SOALAN 3

CLO 1
C2

a)   Given matrix $A = \begin{bmatrix} 2 & -3 & 5 \\ 7 & 2 & 10 \end{bmatrix}$.

         Diberi matrik $A = \begin{bmatrix} 2 & -3 & 5 \\ 7 & 2 & 10 \end{bmatrix}$.

     i.   Express the order of matrix A,

           Nyatakan peringkat bagi matriks A,

           [1 mark]

           [*1 markah*]

     ii.   Convert matrix A to matrix A^T.

           Tukarkan matriks A kepada matriks A^T.

           [2 marks]

           [*2 markah*]

     iii.   Express the elements of a_{11}, a_{12}, a_{21} and a_{23}

           Nyatakan unsur-unsur a_{11}, a_{12}, a_{21} dan a_{23}

           [4 marks]

           [*4 markah*]

CLO 1
C3

b) If $B = \begin{bmatrix} 2 & -3 \\ 7 & -1 \\ 7 & 4 \end{bmatrix}, C = \begin{bmatrix} 2 & 8 & 0 \\ -7 & 0 & 1 \\ 1 & 3 & 3 \end{bmatrix}, D = \begin{bmatrix} 2 & 1 & 3 \\ 5 & 3 & 4 \end{bmatrix}$ and $E = \begin{bmatrix} 1 & -3 \\ 4 & -1 \\ 3 & 3 \end{bmatrix}$, calculate:

Jika $B = \begin{bmatrix} 2 & -3 \\ 7 & -1 \\ 7 & 4 \end{bmatrix}, C = \begin{bmatrix} 2 & 8 & 0 \\ -7 & 0 & 1 \\ 1 & 3 & 3 \end{bmatrix}, D = \begin{bmatrix} 2 & 1 & 3 \\ 5 & 3 & 4 \end{bmatrix}$ *dan* $E = \begin{bmatrix} 1 & -3 \\ 4 & -1 \\ 3 & 3 \end{bmatrix}$, *kirakan*

   i. B+E

[2 marks]
[*2 markah*]

   ii. $(B+E)^T - 3D$

[3 marks]
[*3 markah*]

   iii. 2DC

[3 marks]
[*3 markah*]

CLO 2
C3

c) Calculate the values of x, y and z for the following linear simultaneous equation by using the Inverse Matrix Method.

Kirakan nilai x, y dan z bagi persamaan linear serentak berikut dengan menggunakan Kaedah Matrik Songsang.

$$x - y - z = 1$$
$$2x - y + 2z = 8$$
$$x + 2y + 2z = 10$$

[10 marks]
[*10 markah*]

QUESTION 4

SOALAN 4

CLO 1
C2

a)   Given P, Q and R are the point with coordinates $(2,3,2)$, $(-1,4,3)$ and $(-2,5,1)$ respectively.

Diberi P, Q dan R adalah koordinat bagi titik $(2,3,2)$, $(-1,4,3)$ dan $(-2,5,1)$ masing-masing.

    i.   Express the position vector of each point in the form of i, j and k.

        Nyatakan vektor posisi bagi setiap titik dalam bentuk i , j dan k.

[3 marks]

[*3 markah*]

    ii.   Find the vector $\overrightarrow{PQ}$ and vector $\overrightarrow{QR}$.
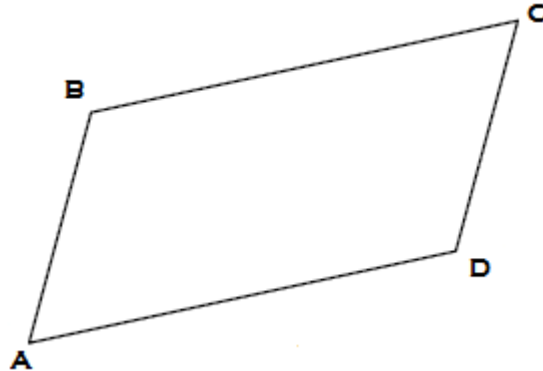
        Dapatkan vektor PQ dan vektor QR.

[4 marks]

[*4 markah*]

CLO 1
C3

b)

  i.   ABCD in **Figure 4(b) i** is a parallelogram.

        *ABCD dalam **Rajah 4(b) i** adalah sebuah segiempat selari.*

Figure 4(b) i / *Rajah 4(b) i*

Based on Figure **4(b) i**, write the single vector for $\overrightarrow{AB} + \overrightarrow{BD}$ and

$\overrightarrow{AD} + \overrightarrow{AB}$.

*Berdasarkan dengan Rajah **4(b) i**, tuliskan vector tunggal bagi*

$\overrightarrow{AB} + \overrightarrow{BD}$ *dan* $\overrightarrow{AD} + \overrightarrow{AB}$.

[4 marks]

[*4 markah*]

  ii.   Given $A = (5,-3,-2)$ and $B = (3,2,-3)$. Calculate the unit vector in the

        direction of $\overrightarrow{AB}$.

        Diberi $A = (5,-3,-2)$ dan $B = (3,2,-3)$. Kirakan vektor unit pada arah

        $\overrightarrow{AB}$.

[4 marks]

[*4 markah*]

CLO 2
C3

c)   Given the position vector $\overrightarrow{OR} = 4i + 3j - 6k$, $\overrightarrow{OS} = 2i - 4j + k$ and $\overrightarrow{OT} = -3i + 2j - 2k$. Calculate:

Diberi vector kedudukan $\overrightarrow{OR} = 4i + 3j - 6k$, $\overrightarrow{OS} = 2i - 4j + k$ dan $\overrightarrow{OT} = -3i + 2j - 2k$. Kirakan:

    i.   Vector $\overrightarrow{RS}$ and vector $\overrightarrow{ST}$.

           Vektor $\overrightarrow{RS}$ dan vektor $\overrightarrow{ST}$.

[2 marks]

[*2 markah*]

    ii. $\overrightarrow{RS} \times \overrightarrow{ST}$

[3 marks]

[*3 markah*]
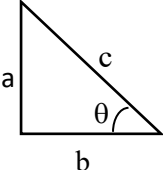
    iii. $\overrightarrow{RT} \bullet \left(\overrightarrow{RS} + \overrightarrow{ST} \right)$

[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;**

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

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