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 1 : 2026/2027

DBM20233 : ENGINEERING MATHEMATICS

TARIKH : 29 OKTOBER 2026
MASA : 8.30 PAGI – 10.30 PAGI (2 JAM)

Kertas ini mengandungi **SEMBILAN (9)** halaman bercetak.

Struktur (4 soalan)

Dokumen sokongan yang disertakan : Formula & Kertas Graf

JANGAN BUKA KERTAS SOALAN INI SEHINGGA DIARAHKAN
(CLO yang tertera hanya sebagai rujukan)

TERBUKA

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) Given that $A = -1 + i, B = 6 - 2i$ and $C = -3 - 4i$. Calculate the following:
Diberi $A = -1 + i, B = 6 - 2i$ dan $C = -3 - 4i$. Kira yang berikut:

i. $\frac{1}{2}B$

[2 marks]
[2 *markah*]

ii. $A \times C$

[4 marks]
[*4 markah*]

CLO2 (b) Determine the modulus and argument of a complex number, $z = 5 - 12i$. Then, draw the Argand diagram using graph paper.
Kira modulus dan hujah bagi nombor kompleks $z = 5 - 12i$. Kemudian, lukis rajah Argand menggunakan kertas graf.

[7 marks]
[*7 markah*]

CLO2 (c) i. Convert the following expression in exponential form.
Tukarkan ungkapan berikut dalam bentuk eksponen.

$z = 2(cos\,40° + i\,sin\,40°)$

TERBUKA

[3 marks]
[*3 markah*]

ii. Simplify the following expression and express the answer in polar form.
Permudahkan ungkapan berikut dalam bentuk kutub.

$$\frac{30\angle 215^\circ \times 3(\cos 30^\circ + i \sin 30^\circ)}{3\angle 55^\circ}$$

[4 marks]
[*4 markah*]

iii. Given that $Z_1 = 45e^{2.09i}$ and $Z_2 = 16(\cos 45^\circ + i \sin 45^\circ)$. Solve $Z_1 \times Z_2$ in trigonometric form.
Diberi $Z_1 = 45e^{2.09i}$ *dan* $Z_2 = 16(\cos 45^\circ + i \sin 45^\circ)$. *Selesaikan* $Z_1 \times Z_2$ *dalam bentuk trigonometri.*

TERBUKA

[5 marks]
[*5 markah*]

QUESTION 2

SOALAN 2

CLO1

(a) Given matrices $A = \begin{bmatrix} 4 & -2 & 1 \\ 0 & 7 & -5 \\ 3 & 8 & 6 \end{bmatrix}, B = \begin{bmatrix} -1 & 5 \\ 6 & 2 \\ -3 & 9 \end{bmatrix}$ and $C = \begin{bmatrix} 7 & 0 & -4 \\ 1 & -8 & 2 \end{bmatrix}$.

Identify:

Diberi matrik $A = \begin{bmatrix} 4 & -2 & 1 \\ 0 & 7 & -5 \\ 3 & 8 & 6 \end{bmatrix}, B = \begin{bmatrix} -1 & 5 \\ 6 & 2 \\ -3 & 9 \end{bmatrix}$ *dan* $C = \begin{bmatrix} 7 & 0 & -4 \\ 1 & -8 & 2 \end{bmatrix}$.

Tentukan:

i. the elements of a_{33}, b_{31}, b_{12} and c_{23}.

unsur-unsur pada a_{33}, b_{31}, b_{12} dan c_{23}.

[4 marks]

[*4 markah*]

ii. the matrix A^T and state its size.

matrik A^T *dan berikan saiznya.*

[2 marks]

[*2 markah*]

CLO2

(b) Given matrices $A = \begin{bmatrix} 2 & 3 & 5 \\ -3 & 0 & 2 \end{bmatrix}$, $B = \begin{bmatrix} 4 & -2 & 9 \\ 1 & 10 & 2 \end{bmatrix}$ and $C = \begin{bmatrix} 6 & 1 \\ 3 & -2 \\ 4 & 9 \end{bmatrix}$.

Calculate:

Diberi matriks $A = \begin{bmatrix} 2 & 3 & 5 \\ -3 & 0 & 2 \end{bmatrix}$, $B = \begin{bmatrix} 4 & -2 & 9 \\ 1 & 10 & 2 \end{bmatrix}$ dan $C = \begin{bmatrix} 6 & 1 \\ 3 & -2 \\ 4 & 9 \end{bmatrix}$.

Kirakan:

i. $2A - B$

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[4 marks]

[*4 markah*]

ii. $A + 2C^T$

[5 marks]

[*5 markah*]

CLO2 (c) Calculate the values of x, y, and z for the simultaneous equations using Cramer's Rule. Given that determinant, $|A| = 6$.

Kira nilai x, y, dan z bagi persamaan linear serentak berikut menggunakan Petua Cramer. Diberi bahawa penentu matrik, $|A| = 6$.

$$2x + y + z = 8$$
$$x - y + 2z = 5$$
$$3x + 2y - z = 5$$

[10 marks]

[*10 markah*]

TERBUKA

QUESTION 3

SOALAN 3

CLO1 (a) Given, $\overrightarrow{OP} = 4i - 2j + k$, $\overrightarrow{OQ} = i + 3j - 2k$ and $\overrightarrow{OR} = 5i + j + 4k$.

Diberi $\overrightarrow{OP} = 4i - 2j + k$, $\overrightarrow{OQ} = i + 3j - 2k$ *dan* $\overrightarrow{OR} = 5i + j + 4k$.

i. Express $\overrightarrow{PQ}$ and $\overrightarrow{QR}$ in terms of i, j and k.

Ungkapkan $\overrightarrow{PQ}$ *dan* $\overrightarrow{QR}$ *dalam sebutan* i, j *dan* k.

[4 marks]

[*4 markah*]

ii. Calculate the unit vector for $\overrightarrow{PR}$.

Kirakan vektor unit untuk $\overrightarrow{PR}$.

[6 marks]

[*6 markah*]

CLO2 (b) Given that vector $\overrightarrow{OA}$ is $\begin{pmatrix} 2 \\ 1 \\ 2 \end{pmatrix}$ and vector $\overrightarrow{OB}$ is $\begin{pmatrix} 1 \\ 2 \\ 2 \end{pmatrix}$. Calculate:

Diberikan bahawa vektor $\overrightarrow{OA}$ *ialah* $\begin{pmatrix} 2 \\ 1 \\ 2 \end{pmatrix}$ *and vektor* $\overrightarrow{OB}$ *ialah* $\begin{pmatrix} 1 \\ 2 \\ 2 \end{pmatrix}$. *Kirakan:*

i. $\overrightarrow{OA} \bullet \overrightarrow{OB}$

[2 marks]

[*2 markah*]

ii. the angle between the vector $\overrightarrow{OA}$ and $\overrightarrow{OB}$.

sudut antara vektor $\overrightarrow{OA}$ *dan* $\overrightarrow{OB}$.

TERBUKA

[5 marks]

[*5 markah*]

CLO2

(c) Given a triangle with coordinates $P(2,1,-1)$, $Q(5,3,2)$ and $R(1,4,1)$. Calculate:
Diberi sebuah segi tiga dengan koordinat $P(2,1,-1)$, $Q(5,3,2)$ *dan* $R(1,4,1)$.
Kirakan:

i. $\overrightarrow{PQ} \times \overrightarrow{PR}$

[6 marks]
[*6 markah*]

ii. area of the parallelogram formed by vectors $\overrightarrow{PQ}$ *and* $\overrightarrow{PR}$.
luas segi empat selari yang dibentuk oleh vector $\overrightarrow{PQ}$ *dan* $\overrightarrow{PR}$.

TERBUKA

[2 marks]
[*2 markah*]

QUESTION 4

SOALAN 4

CLO1 (a) State **THREE** measures of central tendency.

*Nyatakan **TIGA** ukuran kecenderungan memusat.*

[3 marks]

[*3 markah*]

CLO2 (b) Based on the data given, calculate:

Berdasarkan data yang diberi, kira:

$$5, 7, 7, 8, 9, 9, 10, 11, 12, 14$$

i. mode and mean

mod dan min

[5 marks]

[5 *markah*]

ii. standard deviation

sisihan piawai

TERBUKA

[5 marks]

[*5 markah*]

CLO2

(c) Table 4(c) shows the production output of 50 machines in a factory.
Jadual 4(c) menunjukkan hasil pengeluaran bagi 50 buah mesin di sebuah kilang.

Table 4(c) / *Jadual 4(c)*

Production Output (units) *Hasil Pengeluaran (unit)*	Number of machines *Bilangan mesin*
10 – 19	7
20 – 29	12
30 – 39	16
40 – 49	10
50 – 59	5

Based on Table 4(c), calculate:
Berdasarkan Jadual 4(c), kirakan:

i. mean
min

[5 marks]
[5 *markah*]

ii. variance
varians

[7 marks]
[7 *markah*]

TERBUKA

SOALAN TAMAT

FORMULA SHEET FOR ENGINEERING MATHEMATICS (DBM20233)

COMPLEX NUMBER

1. $Modulus\ of\ z, r = \sqrt{a^2 + b^2}$
2. $Argument\ of\ z, \theta = tan^{-1}\left(\frac{b}{a}\right)$
3. $Cartesian\ Form;\ z = a + bi$
4. $Polar\ Form;\ z = r \angle \theta$
5. $Exponential\ Form; z = re^{i\theta}$
6. $Trigonometric\ Form; z = r(\cos\theta + i\sin\theta)$
7. $Degree\ to\ radian;\ \theta \times \frac{\pi}{180°}$
8. *Multiplication of complex number*
   $z_1 \times z_2 = r_1 \cdot r_2 \angle(\theta_1 + \theta_2)$
9. *Division of complex number*
   $\frac{z_1}{z_2} = \frac{r_1}{r_2} \angle(\theta_1 - \theta_2)$

VECTOR AND SCALAR

1. $Unit\ Vector;\ \hat{u} = \frac{\bar{u}}{|u|}$
2. $\cos\theta = \frac{\bar{A} \bullet \bar{B}}{|A||B|}$
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;*
   $A = |\overrightarrow{AB} \times \overrightarrow{AC}|$
6. *Area of triangle;*
   $A = \frac{1}{2} \times |\overrightarrow{AB} \times \overrightarrow{AC}|$

MATRICES

1. $Cofactor;\ C = (-1)^{i+j}M_{ij}$
2. $Inverse;\ A^{-1} = \frac{1}{|A|}\ adj\ (A)$
3. $Adjoin;\ Adj(A) = C^T$
4. *Cramer's rule;*
   $x = \frac{|A_1|}{|A|}, \quad y = \frac{|A_2|}{|A|}, \quad z = \frac{|A_3|}{|A|}$

STATISTICS		
Number of class	*Sturges Rule,* $k = 1 + 3.33 \log n$	*Rule of Thumb,* $2^k > n$
Mean	$\bar{x} = \frac{\sum x}{n}$	$\bar{x} = \frac{\sum (fx)}{\sum f}$
Median	$Median = L_m + \left(\frac{\frac{N}{2} - F}{f_m}\right) C$	
Mode	$Mode = L_{M_o} + \left(\frac{d_1}{d_1 + d_2}\right) C$	
Quartile	$Q_k = L_{Q_k} + \left(\frac{\frac{kN}{4} - F}{f_{Q_k}}\right) C; \quad k = 1, 2, 3$	
Decile	$D_k = L_{D_k} + \left(\frac{\frac{kN}{10} - F}{f_{D_k}}\right) C; \quad k = 1, 2, 3 \ldots 9$	
Percentile	$P_k = L_{P_k} + \left(\frac{\frac{kN}{100} - F}{f_{P_k}}\right) C; \quad k = 1, 2, 3 \ldots 99$	
Mean Deviation	$E = \frac{\sum \lvert x - \bar{x} \rvert}{n}$	$E = \frac{\sum (\lvert x - \bar{x} \rvert f)}{\sum f}$
Variance	$s^2 = \frac{\sum (x - \bar{x})^2}{n}$	$s^2 = \frac{\sum [(x - \bar{x})^2 f]}{\sum f}$ $s^2 = \frac{\sum fx^2}{\sum f} - \left[\frac{\sum fx}{\sum f}\right]^2$
Standard Deviation	$s = \sqrt{variance}$	