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 & KOMPUTER

PEPERIKSAAN AKHIR

SESI II : 2025/2026

DBM20233 : ENGINEERING MATHEMATICS

TARIKH : 02 MEI 2026
MASA : 8.30 PAGI - 10.30 PAGI (2 JAM)

Kertas soalan 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)

TERBUKA

INSTRUCTION:

This section consists of **FOUR (4)** structured questions. Answers **ALL** questions.

ARAHAN:

*Bahagian ini mengandungi **EMPAT (4)** soalan berstruktur. Jawab **SEMUA** soalan.*

QUESTION 1

SOALAN 1

CLO1 (a) Given that the complex numbers $P = 4 - 3i$, $Q = -2 + 5i$ and $R = 1 - 2i$. Calculate the following:

Diberi nombor kompleks $P = 4 - 3i$, $Q = -2 + 5i$ dan $R = 1 - 2i$. Kirakan yang berikut:

i. $P + Q$

[2 marks]

[2 *markah*]

ii. $(P + Q) \times R$

[4 marks]

[4 *markah*]

CLO2 (b) Calculate the modulus and argument for a complex number, $z = -8 + 4i$. Then, draw the Argand diagram using graph paper.

Kirakan modulus dan argument bagi nombor kompleks $z = -8 + 4i$. Kemudian, lukis rajah Argand dengan menggunakan kertas graf.

TERBUKA

[7 marks]

[7 *markah*]

CLO2

(c) i. Change the following exponential form to polar form.

Tukarkan bentuk eksponen berikut kepada bentuk kutub.

$$z = 3.5e^{1.12i}$$

[2 marks]

[2 *markah*]

ii. Solve the following expression in trigonometric form.

Selesaikan ungkapan berikut dalam bentuk trigonometri.

$$\frac{6e^{1.047i} \times 5(cos\ 45^0 + isin\ 45^0)}{3e^{0.524i}}$$

[5 marks]

[5 *markah*]

iii. Given that $z_1 = 24(cos\ 135^0 + isin\ 135^0)$ and $z_2 = 7\angle 25^0$. Solve $\frac{z_1}{z_2}$ in polar form.

Diberi $z_1 = 24(cos\ 135^0 + isin\ 135^0)$ *dan* $z_2 = 7\angle 25^0$.

Selesaikan $\frac{z_1}{z_2}$ *dalam bentuk kutub.*

TERBUKA

[5 marks]

[5 *markah*]

QUESTION 2

SOALAN 2

CLO1

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

Express:

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

Nyatakan:

i. the elements of A_{12}, A_{31}, B_{22} and C_{21}.

unsur-unsur pada A_{12}, A_{31}, B_{22} *dan* C_{21}.

[4 marks]

[4 *markah*]

ii. the matrix C^{T} and its order.

matriks C^{T} *dan saiznya.*

[2 marks]

[2 *markah*]

(b) Given matrices $P = \begin{bmatrix} 1 & -2 & 4 \\ 3 & 0 & -1 \end{bmatrix}$ and $Q = \begin{bmatrix} -3 & 5 & 2 \\ 4 & -1 & 6 \end{bmatrix}$. Calculate:

Diberi matriks $P = \begin{bmatrix} 1 & -2 & 4 \\ 3 & 0 & -1 \end{bmatrix}$ *dan* $Q = \begin{bmatrix} -3 & 5 & 2 \\ 4 & -1 & 6 \end{bmatrix}$. *Kirakan:*

i. $2P + Q$

[4 marks]

[*4 markah*]

ii. PQ^T

[5 marks]

[*5 markah*]

TERBUKA

CLO2 (c) Calculate the values of p, q and r for the following system of linear simultaneous equations using Inverse Matrix Method. The given determinant and cofactor are 91 and $\begin{bmatrix} 22 & -9 & 8 \\ 9 & 17 & -5 \\ -7 & 7 & 14 \end{bmatrix}$ respectively.

Kirakan nilai p, q and r bagi persamaan serentak linear dengan menggunakan Kaedah Matrik Songsangan. Penentu dan kofaktor matriks yang diberi masing-masing ialah 91 *dan* $\begin{bmatrix} 22 & -9 & 8 \\ 9 & 17 & -5 \\ -7 & 7 & 14 \end{bmatrix}$.

$$3p - q + 2r = 7$$
$$2p + 4q - r = 1$$
$$-p + 2q + 5r = 12$$

[10 marks]

[10 *markah*]

TERBUKA

QUESTION 3

SOALAN 3

CLO1 (a) Given, $\overrightarrow{A} = 2i + 7j - 9k$, $\overrightarrow{B} = i + 3j - k$, and $\overrightarrow{C} = -4i - 3j + 5k$.

Diberi $\overrightarrow{A} = 2i + 7j - 9k$, $\overrightarrow{B} = i + 3j - k$, *dan* $\overrightarrow{C} = -4i - 3j + 5k$.

i. Express $\overrightarrow{AC}$ and $\overrightarrow{AB}$ in terms of i, j *and* k

Ungkapkan $\overrightarrow{AC}$ dan $\overrightarrow{AB}$ *dalam sebutan* i, j dan k

[4 marks]

[*4 markah*]

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

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

[6 marks]

[*6 markah*]

CLO2 (b) P and Q have coordinates (6, 5, 4) and (3, 2, 1) respectively. Compute:

Koordinat P dan Q masing-masing adalah (6, 5, 4) dan (3, 2, 1). Hitungkan:

i. $\overrightarrow{P} \cdot \overrightarrow{Q}$

[2 marks]

[*2 markah*]

ii. the angle between vector $\overrightarrow{P} \cdot \overrightarrow{Q}$

sudut antara dua vektor $\overrightarrow{P} \cdot \overrightarrow{Q}$

[5 marks]

[*5 markah*]

TERBUKA

CLO2

(c) Given the position vectors $\overrightarrow{OL} = i - 2j - 3k$, $\overrightarrow{OM} = 2i - 3j + 2k$ and $\overrightarrow{ON} = 4i + 2j - k$. Calculate:

Diberi vektor kedudukan $\overrightarrow{OL} = i - 2j - 3k$, $\overrightarrow{OM} = 2i - 3j + 2k$ *dan* $\overrightarrow{ON} = 4i + 2j - k$. *Kira:*

i. the vector $\overrightarrow{LM}$ X $\overrightarrow{MN}$

[6 marks]

[*6 markah*]

ii. the area of the parallelogram formed by $\overrightarrow{LM}$ and $\overrightarrow{MN}$

luas segiempat selari yang terbentuk oleh $\overrightarrow{LM}$ *dan* $\overrightarrow{MN}$

[2 marks]

[*2 markah*]

TERBUKA

QUESTION 4

SOALAN 4

CLO1

(a) State the definition of mean, median, and mode.

Nyatakan definisi min, median dan mod.

[3 marks]

[3 *markah*]

CLO2

(b) Based on the data given, calculate:

Berdasarkan data yang diberi, hitungkan:

6 , 9 , 12 , 13 , 11 , 12 , 7 , 8 , 12

i. mean

min

[4 marks]

[4 *markah*]

ii. mean deviation

sisihan min

[6 marks]

[6 *markah*]

TERBUKA

(c) Table 4 (c) shows the marks of 45 students in the Mathematics test.
Jadual 4 (c) menunjukkan markah yang diperolehi oleh 45 orang pelajar dalam ujian Matematik.

Time (minutes)	Number of Students
1 - 20	4
21- 40	6
41 - 60	12
61 - 80	15
81 - 100	8

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

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

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

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

TERBUKA

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	$s = \sqrt{variance}$	

TERBUKA