

SECTION A : 25 MARKS (JKE,JKP,JKA,JKPK and JKM)
BAHAGIAN A : 25 MARKAH (JKE,JKP,JKA,JKPK dan JKM)

INSTRUCTION:

This section consists of **TWO (2)** structured questions. Answer **ONE (1)** question only.

ARAHAN:

Bahagian ini mengandungi **DUA (2)** soalan struktur. Jawab **SATU (1)** soalan sahaja.

QUESTION 1
SOALAN 1

- (a) Expand $(2x + \frac{1}{2x})^5$ in ascending power of x .

Kembangkan $(2x + \frac{1}{2x})^5$ dalam kuasa- x yang menaik.

[5 marks]

[5 markah]

- (b) Expand $\frac{x+2}{(1+x)^3}$ until the first four terms.

Kembangkan $\frac{x+2}{(1+x)^3}$ sehingga empat sebutan pertama

[6 marks]

[6 markah]

- (c) Determine the coefficient of x^6 in the expansion of

$$\left(x - \frac{2}{x}\right)^8$$

Dapatkan pekali bagi x^6 dalam kembangan $\left(x - \frac{2}{x}\right)^8$

[7 marks]

[7 markah]

SULIT

POLITEKNIK
 Jabatan Pengajian Politeknik

BAHAGIAN PEPERIKSAAN DAN PENILAIAN
 JABATAN PENGAJIAN POLITEKNIK
 KEMENTERIAN PENGAJIAN TINGGI

JABATAN MATEMATIK, SAINS & KOMPUTER

PEPERIKSAAN AKHIR

SESI DISEMBER 2012

BA501 : ENGINEERING MATHEMATICS 4

TARIKH : 22 APRIL 2013 (ISNIN)

TEMPOH : 2 JAM (8.30 A.M-10.30 A.M)

Kertas ini mengandungi **EMPAT BELAS BELAS (14)** halaman bercetak.

Pelajar dikehendaki menjawab **EMPAT (4)** soalan **SAHAJA**

Bahagian A : Struktur (2 soalan)

Bahagian B : Struktur (2 soalan)

Bahagian C : Struktur (2 soalan)

Bahagian D : Struktur (2 soalan)

Bahagian E : Jawab **SATU (1)** soalan daripada mana-mana

bahagian **A,B atau C (untuk JKE,JKP,JKA dan JKPK)**

dan **Bahagian A,B atau D (untuk JKM)** selain daripada soalan yang telah dijawab.

Dokumen sokongan yang disertakan : Formula

JANGAN BUKA KERTAS SOALAN INI SEHINGGA DIARAHKAN

(CLO yang tertera hanya sebagai rujukan)

SULIT

QUESTION 2

SOALAN 2

CLO1
C3

- (a) Find power series of the following functions until the first four terms.

Cari kembangan Siri Kuasa bagi ungkapan di bawah sehingga sebutan keempat:

i. $e^{2x}(e^{-x} - e^{3x})$

[7 marks]

[7 markah]

ii. $\ln(1+2x)(1-x^2)$

[9 marks]

[9 markah]

CLO1
C3

- (b) Find the Taylor Series of
- $f(x) = (5-x)^5$
- at
- $x_0 = 1$
- until the terms of
- x^4
- .

Dapatkan Siri Taylor bagi $f(x) = (5-x)^5$ pada $x_0 = 1$ sehingga sebutan mengandungi x^4 .

[9 marks]

[9 markah]

(d)

Write the expansion of $\left(2 + \frac{1}{4}x\right)^{10}$ in ascending power of x until the first four terms. Hence find the value of $(2.025)^{10}$ correct to nearest integer.*Tulis empat sebutan pertama dalam kuasa x menaik bagi kembangan* $\left(2 + \frac{1}{4}x\right)^{10}$. kemudian, dapatkan nilai $(2.025)^{10}$ tepat kepada*angka bulat yang hampir.*

[7 marks]

[7 markah]

CLO2
C3

- (b) A plane contains A (1,5,12) , B (0,0,0) and C (3,5,1). Find the area of triangle ABC.
Satu satah mempunyai titik A (1,5,12), B (0, 0, 0) dan C (3,5,1). Dapatkan luas bagi segitiga ABC.

[7 marks]

[7 markah]

SECTION B : 25 MARKS (JKE,JKP,JKA,JKPK and JKM)
BAHAGIAN B : 25 MARKAH (JKE,JKP,JKA,JKPK dan JKM)

INSTRUCTION :

This section consists of **TWO (2)** structured question. Choose to answer **ONE (1)** question only.

ARAHAN :

Bahagian ini mengandungi DUA (2) soalan struktur. Jawab SATU (1) soalan sahaja.

QUESTION 3.**SOALAN 3**

- CLO2 (a) Given that $\vec{P} = 2i + 4j + 6k$, $= 2i + 4j + 3k$, find :

Diberi $\vec{P} = 2i + 4j + 6k$, $Q = 2i + 4j + 3k$, dapatkan ;

CLO2
C2

i. \vec{PQ}

[5 marks]

[5 markah]

CLO2
C2

ii. $\vec{P} \cdot \vec{Q}$

[2 marks]

[2 markah]

CLO2
C3

iii. $\vec{P} \times \vec{Q}$

[4 marks]

[4 markah]

CLO2
C3

iv. Direction angle of \vec{PQ}

Sudut Arah \vec{PQ}

[7 marks]

[7 markah]

SECTION C : 25 MARKS (JKE,JKP,JKA and JKPK)
BAHAGIAN C : 25 MARKAH (JKE,JKP,JKA dan JKPK)

INSTRUCTION:

This section consists of **TWO (2)** structured questions. Answer **ONE (1)** question only.

ARAHAN:

Bahagian ini mengandungi **DUA (2)** soalan berstruktur. Jawab **SATU (1)** soalan sahaja.

QUESTION 5**SOALAN 5**CLO 3
C2

- (a) Calculate the Laplace Transform of function $f(t)$ using the definition of :

Hitungkan Jelmaan Laplace bagi fungsi $f(t)$ menggunakan definisi Penjelmaan Laplace:

$$F(s) = \int_0^{\infty} e^{-st} f(t) dt$$

i. $f(t) = 5$

[5 marks]

[5 markah]

ii. $f(t) = \frac{1}{3} e^{-2t}$

[7 marks]

[7 markah]

QUESTION 4**SOALAN 4**

Express each of the followings in partial fraction form:

Tunjukkan persamaan berikut dalam bentuk pecahan separa:

CLO2
C2

(a)
$$\frac{8x-42}{x^2+3x-18}$$

[5 marks]

[5 markah]

CLO2
C3

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

[10 marks]

[10 markah]

CLO2
C3

(c)
$$\frac{6-x}{(1-x)(4+x^2)}$$

[10 marks]

[10 markah]

QUESTION 6

SOALAN 6

CLO 3
C2

- (a) Determine the Inverse of Laplace Transform for:
Tentukan songsangan bagi Penjelmaan Laplace berikut:

i. $L^{-1}\left\{\frac{1}{s^2 - 25}\right\}$

[3 marks]

[3 markah]

ii. $L^{-1}\left\{\frac{6}{s-6} - \frac{6}{s^2-9}\right\}$

[4 marks]

[4 markah]

CLO 3
C3

- (b) Write the expression in the partial fraction and find the Inverse Laplace Transform for:
Tuliskan ungkapan berikut dalam bentuk Pecahan separa dan seterusnya dapatkan songsangan bagi Penjelmaan Laplace bagi:

i. $\frac{s}{(s-1)(s+2)}$

[8 marks]

[8 markah]

ii. $\frac{s}{(s-1)(s^2-4)}$

[10 marks]

[10 markah]

CLO 3
C2

- (b) Find the Laplace Transform of the following functions $f(t)$ by using Table of Laplace Transform.

Dapatkan Jelmaan Laplace bagi fungsi $f(t)$ dengan menggunakan jadual Laplace.

i. $f(t) = -7t - 3e^{-2t}$

[3 marks]

[3 markah]

ii. $f(t) = 6 \cos 3t - 5 \sin 2t$

[4 marks]

[4 markah]

CLO 3
C3

- (c) Show that $L\{e^t t^2\} = \frac{2}{(s-1)^3}$ by using theorem multiplication by t^n .

Tunjukkan $L\{e^t t^2\} = \frac{2}{(s-1)^3}$ dengan menggunakan teorem pendaraban dengan t^n .

[6 marks]

[6 markah]

- (c) Sketch the parabola $(y - 2)^2 = 12(x - 1)$. Show clearly the vertex, the focus and the directrix of the parabola in the graph.

Lakarkan parabola $(y - 2)^2 = 12(x - 1)$. Tunjukkan dengan jelas verteks, titik fokus dan direktriks bagi parabola tersebut dalam graf tersebut

[9 marks]

[9 markah]

SECTION D: 25 MARKS (JKM)

BAHAGIAN D : 25 MARKAH (JKM)

INSTRUCTION:

This section consists of **TWO (2)** questions. Answer **ONE (1)** question only.

ARAHAN:

Bahagian ini mengandungi **DUA (2)** soalan. Jawab **SATU (1)** soalan sahaja.

QUESTION 7

SOALAN 7

CLO4
C2

- (a) Determine the centre and the radius of the circles with equations:

Tentukan pusat dan jejari bagi bulatan yang mempunyai persamaan :

i. $(x - y)^2 + y^2 = 25$

ii. $x^2 + y^2 - 4x - 2y = 4$

[8 marks]

[8 markah]

CLO4
C3

- (b) Determine the tangent and normal line equation to a circle with equation $x^2 + y^2 - 6x - 2y - 3 = 0$ at the point (5,4) on the circle.

Tentukan persamaan garis tangen dan garis normal kepada bulatan yang dimiliki oleh persamaan

$x^2 + y^2 - 6x - 2y - 3 = 0$ di titik (5,4) pada bulatan tersebut.

[8 marks]

[8 markah]

SECTION E : 25 MARKS (JKE,JKP,JKA,JKPK and JKM)
BAHAGIAN E : 25 MARKAH (JKE,JKP,JKA,JKPK dan JKM)

Answer **ONE (1)** question from section **A, B or C** (for **JKE, JPK,JKA and JKPK**) and section **A, B or D** (for **JKM**) apart from the questions that has been answered.

Jawab **SATU (1)** soalan daripada mana-mana Bahagian **A, B atau C** (untuk **JKE, JKP,JKA dan JKPK**) dan Bahagian **A, B atau D** (untuk **JKM**) selain daripada soalan yang telah dijawab.

SOALAN TAMAT

QUESTION 8

SOALAN 8

CLO4
C3

- (a) Given an ellipse equation $9x^2 + 4y^2 = 36$. Calculate the focus point, major axis length, vertices and eccentricity of the ellipse. Then, sketch the ellipse.

Diberi persamaan elips $9x^2 + 4y^2 = 36$. Kirakan titik fokus, panjang paksi major, verteks dan esentriks elips tersebut. Kemudian, lakarkan elips tersebut.

[15 marks]

[15 markah]

CLO4
C3

- (b) Calculate the centre, focus point, vertices, asymptotes and directrix for hyperbola.

Kira titik pusat, titik focus, vertex, asimptot dan direktriks untuk hiperbola.

$$\frac{x^2}{9} - \frac{y^2}{25} = 1$$

[10 marks]

[10 markah]

Laplace Transform

No.	$f(t)$	$F(s)$	No.	$f(t)$	$F(s)$
1.	a	$\frac{a}{s}$	12.	$e^{-at} \sin \omega t$	$\frac{\omega}{(s+a)^2 + \omega^2}$
2.	t^n	$\frac{n!}{s^{n+1}}$	13.	$e^{-at} \cos \omega t$	$\frac{s+a}{(s+a)^2 + \omega^2}$
3.	$\frac{t^{n-1}}{(n-1)!}$	$\frac{1}{s^n}$	14.	$\sinh \omega t$	$\frac{\omega}{s^2 - \omega^2}$
4.	e^{-at}	$\frac{1}{s+a}$	15.	$\cosh \omega t$	$\frac{s}{s^2 - \omega^2}$
5.	te^{-at}	$\frac{1}{(s+a)^2}$	16.	$e^{-at} \sinh \omega t$	$\frac{\omega}{(s+a)^2 - \omega^2}$
6.	$t^n e^{at}$	$\frac{n!}{(s-a)^{n+1}}$	17.	$e^{-at} \cosh \omega t$	$\frac{s+a}{(s+a)^2 - \omega^2}$
7.	$t^n \cdot f(t)$	$(-1)^n \frac{d^n}{ds^n} [F(s)]$	18.	$f_1(t) + f_2(t)$	$F_1(s) + F_2(s)$
8.	$\sin \omega t$	$\frac{\omega}{s^2 + \omega^2}$	19.	$\int_0^t f(u) du$	$\frac{F(s)}{s}$
9.	$\cos \omega t$	$\frac{s}{s^2 + \omega^2}$	20.	$f(t-a)u(t-a)$	$e^{-as} F(s)$
10.	$t \sin \omega t$	$\frac{2\omega s}{(s^2 + \omega^2)^2}$	21.	First derivative $\frac{dy}{dt}, y'(t)$	$sY(s) - y(0)$
11.	$t \cos \omega t$	$\frac{s^2 - \omega^2}{(s^2 + \omega^2)^2}$	22.	Second derivative $\frac{d^2y}{dt^2}, y''(t)$	$s^2Y(s) - sy(0) - y'(0)$

Trigonometry Identity

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

Non Linear Equation (Circle)

1.	$(x-a)^2 + (y-b)^2 = r^2$
2.	$x^2 + y^2 + 2gx + 2fy + c = 0$ $r = \sqrt{g^2 + f^2 - c}$ center = $(-g, -f)$
3.	Equation of a tangent and normal line, $y - y_1 = m(x - x_1)$

Binomial Expansion

1.	$(a+x)^n = a^n + {}^nC_1 a^{n-1} x + {}^nC_2 a^{n-2} x^2 + \dots + x^n$ (n = positive integer)
2.	$(1+x)^n = 1 + nx + \frac{n(n-1)x^2}{2!} + \frac{n(n-1)(n-2)x^3}{3!} + \dots + \infty$ (n = negative integer or fraction)

Power Series

1.	$e^x = 1 + x + \frac{x^2}{2!} + \frac{x^3}{3!} + \frac{x^4}{4!} + \dots + \frac{x^n}{n!}$
2.	$\ln(1+x) = x - \frac{x^2}{2} + \frac{x^3}{3} - \frac{x^4}{4} + \dots + (-1)^{n-1} \frac{x^n}{n}$
3.	$f(x) = f(0) + f'(0)x + \frac{f''(0)x^2}{2!} + \frac{f'''(0)x^3}{3!} + \dots + \frac{f^{(n)}(0)x^n}{n!}$ (MACLAURIN)
4.	$f(x) = f(x_0) + f'(x_0)(x-x_0) + \frac{f''(x_0)(x-x_0)^2}{2!} + \frac{f'''(x_0)(x-x_0)^3}{3!} + \dots + \frac{f^{(n)}(x_0)(x-x_0)^n}{n!}$ (TAYLOR)

Vector & Scalar

1.	$\vec{A} \cdot \vec{B} = a_1 a_2 + b_1 b_2 + c_1 c_2$	3.	Unit Vector, $\hat{u} = \frac{\vec{u}}{ u }$	5.	Direction Cosine \overline{OP} $\cos \alpha = \frac{x}{ \overline{OP} }$ $\cos \beta = \frac{y}{ \overline{OP} }$ $\cos \gamma = \frac{z}{ \overline{OP} }$
2.	$\vec{A} \times \vec{B} = \begin{pmatrix} i & j & k \\ a_1 & b_1 & c_1 \\ a_2 & b_2 & c_2 \end{pmatrix}$	4.	$\cos \theta = \frac{\vec{A} \cdot \vec{B}}{ \vec{A} \vec{B} }$	6.	Area of triangle ABC $\frac{1}{2} \vec{AB} \times \vec{BC} $

ELLIPSE

The properties of the ellipse with center (h, k) as follows :

Major axis	Parallel to x - axis		Parallel to y - axis	
Foci	$(h + c, k)$	$(h - c, k)$	$(h, k + c)$	$(h, k - c)$
Vertices	$(h + a, k)$	$(h - a, k)$	$(h, k + a)$	$(h, k - a)$
Equation	$\frac{(x - h)^2}{a^2} + \frac{(y - k)^2}{b^2} = 1$ $a > b$ and $b^2 = a^2 - c^2$		$\frac{(x - h)^2}{b^2} + \frac{(y - k)^2}{a^2} = 1$ $a > b$ and $b^2 = a^2 - c^2$	

HYPERBOLA

The properties of the hyperbola with center $(0, 0)$ as follows :

Transverse axis	x - axis		y - axis	
Foci	$(c, 0)$	$(-c, 0)$	$(c, 0)$	$(-c, 0)$
Vertices	$(a, 0)$	$(-a, 0)$	$(a, 0)$	$(-a, 0)$
Equation	$\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$ $b^2 = c^2 - a^2$		$\frac{y^2}{a^2} - \frac{x^2}{b^2} = 1$ $b^2 = c^2 - a^2$	
Asymptotes	$y = \frac{b}{a}x$	$y = -\frac{b}{a}x$	$y = \frac{a}{b}x$	$y = -\frac{a}{b}x$

HYPERBOLA

The properties of the hyperbola with center (h, k) as follows :

Transverse axis	x - axis		y - axis	
Foci	$(h + c, k)$	$(h - c, k)$	$(h, k + c)$	$(h, k - c)$
Vertices	$(h + a, k)$	$(h - a, k)$	$(h, k + a)$	$(h, k - a)$
Equation	$\frac{(x - h)^2}{a^2} - \frac{(y - k)^2}{b^2} = 1$ $b^2 = c^2 - a^2$		$\frac{(y - k)^2}{a^2} - \frac{(x - h)^2}{b^2} = 1$ $b^2 = c^2 - a^2$	
Asymptotes	$y - k = \frac{b}{a}(x - h)$	$y - k = -\frac{b}{a}(x - h)$	$y - k = \frac{a}{b}(x - h)$	$y - k = -\frac{a}{b}(x - h)$

PARABOLA

When the vertex lies at $(0, 0)$ the standard equations for parabolas are:

Axis of symmetry	x - axis	x - axis	y - axis	y - axis
Description	opens right	opens left	opens up	opens down
Vertex	$(0, 0)$	$(0, 0)$	$(0, 0)$	$(0, 0)$
Focus	$(a, 0)$	$(-a, 0)$	$(0, a)$	$(0, -a)$
Directrix	$x = -a$	$x = a$	$y = -a$	$y = a$
Equation	$y^2 = 4ax$	$y^2 = -4ax$	$x^2 = 4ay$	$x^2 = -4ay$

PARABOLA

When the vertex lies at (h, k) the standard equations for parabolas are:

Axis of symmetry	x - axis	x - axis	y - axis	y - axis
Description	opens right	opens left	opens up	opens down
Vertex	(h, k)	(h, k)	(h, k)	(h, k)
Focus	$(h + a, k)$	$(h - a, k)$	$(h, k + a)$	$(h, k - a)$
Directrix	$x = h - a$	$x = h + a$	$y = k - a$	$y = k + a$
Equation	$(y - k)^2 = 4a(x - h)$	$(y - k)^2 = -4a(x - h)$	$(x - h)^2 = 4a(y - k)$	$(x - h)^2 = -4a(y - k)$

ELLIPSE

The properties of the ellipse with center $(0, 0)$ as follows :

Major axis	Parallel to x - axis		Parallel to y - axis	
Foci	$(c, 0)$	$(-c, 0)$	$(0, c)$	$(0, -c)$
Vertices	$(a, 0)$	$(-a, 0)$	$(0, a)$	$(0, -a)$
Vertices	$\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$		$\frac{x^2}{b^2} + \frac{y^2}{a^2} = 1$	
Equation	$a > b > 0$ and $b^2 = a^2 - c^2$		$a > b > 0$ and $b^2 = a^2 - c^2$	