

SULIT



BAHAGIAN PEPERIKSAAN DAN PENILAIAN
JABATAN PENGAJIAN POLITEKNIK
KEMENTERIAN PENDIDIKAN MALAYSIA

JABATAN MATEMATIK, SAINS DAN KOMPUTER

PEPERIKSAAN AKHIR
SESI JUN 2014

BA501 : ENGINEERING MATHEMATICS 4

TARIKH : 29 OKTOBER 2014
MASA : 11.15 AM - 1.15 PM (2 JAM)

Kertas ini mengandungi **SEMBILAN BELAS (19)** halaman bercetak.

Bahagian A: Struktur (2 soalan)

Bahagian B: Struktur (2 soalan)

Bahagian C: Struktur (2 soalan) (**JKE, JKP & JKPK**)

Bahagian D: Struktur (2 soalan) (**JKM**)

Bahagian E: Struktur (1 soalan)

Dokumen sokongan yang disertakan : Formula

JANGAN BUKA KERTAS SOALANINI SEHINGGA DIARAHKAN

(CLO yang tertera hanya sebagai rujukan)

SULIT

SECTION A : 25 MARKS**BAHAGIAN A : 25 MARKAH****INSTRUCTION:**

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

ARAHAN:

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

QUESTION 1**SOALAN 1**

CLO1
C3

- (a) Expand the following algebraic expression by using the method stated in the bracket :

Kembangkan ungkapan algebra yang berikut dengan menggunakan kaedah yang dinyatakan di dalam kurungan :

i) $(y^3 + 2x)^5$ [Binomial Theorem]

[4 marks]

[4 markah]

ii) $\left(2 - \frac{x}{4}\right)^4$ [Pascal Triangle]

[4 marks]

[4 markah]

CLO1
C3

- (b) Find the coefficient of x^6 in the expansion of $\left(x + \frac{1}{2x}\right)^{12}$

Dapatkan pekali bagi x^6 dari pengembangan ungkapan $\left(x + \frac{1}{2x}\right)^{12}$.

[6 marks]

[6 markah]

CLO1 (c) Expand the following expression up to third term :

C3 *Kembangkan ungkapan berikut sehingga sebutan ketiga*

$$\left(\frac{1}{\sqrt{9-7x}} \right)$$

[5 marks]

[5 markah]

CLO1 (d) Expand $\frac{1}{(1+y)^3}$ up to fourth term and estimate $\frac{1}{(1.04)^3}$ by using the expansion.

C3

Write the correct answer to 4 decimal places.

Kembangkan $\frac{1}{(1+y)^3}$ sehingga sebutan ke-empat dan anggarkan nilai bagi

$\frac{1}{(1.04)^3}$ dengan menggunakan pengembangan tersebut. Tuliskan jawapan tepat kepada

4 tempat perpuluhan.

[6 marks]

[6 markah]

QUESTION 2**SOALAN 2**CLO1
C3

- (a) Write the first four term from the following expansion :

Tuliskan empat sebutan pertama dari pengembangan berikut:

i) e^{-4x}

[3 marks]

[3 markah]

ii) $\ln(1 - 3x)$

[3 marks]

[3 markah]

CLO1
C3

- (b) Find the coefficient of x^4 in the expansion of

Dapatkan pekali bagi x^4 dari pengembangan ungkapan

i) $(5 + x^2)e^{-3x}$

[6 marks]

ii) $(3 - 2x^3)\ln(1 + 4x)$

[6 markah]

[6 marks]

[6 markah]

CLO1
C3

- (c) Find the Taylor Series for the following until the first four terms.

Dapatkan pengembangan Siri Taylor dari yang berikut sehingga empat sebutan pertama.

$f(x) = \ln(1 + 5x)$ at $x_0 = 1$

[7 marks]

[7 markah]

SULIT

SECTION B : 25 MARKS**BAHAGIAN B : 25 MARKAH****INSTRUCTION:**

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

ARAHAN:

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

QUESTION 3.**SOALAN 3**

Given that $\vec{OP} = 2\mathbf{i} - 4\mathbf{j} + 5\mathbf{k}$, $\vec{OQ} = 6\mathbf{i} + 2\mathbf{j} - 3\mathbf{k}$, find :

Diberi $\vec{OP} = 2\mathbf{i} - 4\mathbf{j} + 5\mathbf{k}$, $\vec{OQ} = 6\mathbf{i} + 2\mathbf{j} - 3\mathbf{k}$, dapatkan ;

CLO2 C2 (a) \vec{PQ} [4 marks]
 [4 markah]

CLO2 C3 (b) $3\vec{OP} \bullet \vec{OQ}$ [4 marks]
 [4 markah]

CLO2 C3 (c) $\vec{OP} \times \vec{OQ}$ [6 marks]
 [6 markah]

CLO2 C3 (d) $2\vec{OP} - 3\vec{OQ}$ [4 marks]
 [4 markah]

CLO2 (e) Angle between vectors \vec{OP} and \vec{OQ} .
C3

Sudut antara vector \vec{OP} dan \vec{OQ} .

[7 marks]

[7 markah]

CLO2
C3**QUESTION 4****SOALAN 4**

Convert the following fractions into partial fractions:

Tukarkan pecahan berikut kepada pecahan separa.

(a) $\frac{5x-10}{x^2-x-6}$

[6 marks]

[6 markah] 

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

[8 marks]

[8 markah]

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

[11 marks]

[11 markah] 

SECTION C : 25 MARKS
BAHAGIAN C: 25 MARKAH

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 5

SOALAN 5

CLO3
C3

- (a) Find the Laplace Transform by using definition as follows $\int_1^{\infty} e^{-st} F(t) dt$.

Dapatkan jelmaan laplace dengan menggunakan takrifan berikut

i) $f(t) = 5$

[4 marks]

[4 markah]

ii) $f(t) = e^{4t}$

[5 marks]

[5 markah]

(b) Find the Laplace Transform for the following functions using the Laplace Transform table.

Dapatkan jelmaan Laplace dengan menggunakan jadual Jelmaan Laplace bagi fungsi-fungsi di bawah.

CLO3
C2 i) $f(t) = t^2 + 3t^4 - 4t^3$

[3 marks]

[3 markah]

CLO3
C2 ii) $f(t) = t^3 e^{4t} + 7$

[3 marks]

[3 markah]

CLO1
C3 iii) $f(t) = e^{-3t} \sin 5t + t \sin 4t + 5$

[5 marks]

[5 markah]

CLO1
C3 iv) $f(t) = e^{4t} \sin \frac{2t}{3} - t^2 e^{-5t} + e^{-6t}$

[5 marks]

[5 markah]

CLO3

QUESTION 6

C3

SOALAN 6

(a) Determine the Inverse Laplace Transform of :

Tentukan Jelmaan Laplace Songsang bagi :

i) $F(s) = \frac{2s+4}{s^3}$

[3 marks]

[3 markah]

ii) $F(s) = \frac{30}{s^2 + 25} + \frac{3}{s} - \frac{2}{s-1}$

[4 marks]

[4 markah]

iii) $F(s) = \frac{2s}{s^2 - 25} - \frac{6}{s^2 + 4}$

[4 marks]

[4 markah]

(b) Find the Inverse Laplace Transform for the following expressions using Partial Fraction Method

Dapatkan Jelmaan Laplace Songsang bagi penyataan yang berikut menggunakan kaedah Pecahan Separa:

i) $F(s) = \frac{5}{s(s^2 + 1)}$

[8 marks]

[8 markah]

ii) $F(s) = \frac{1}{s(s-3)}$

[6 marks]

[6 markah]

SECTION D : 25 MARKS**BAHAGIAN D: 25 MARKAH****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.

CLO4

QUESTION 7C3 **SOALAN 7**

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

Tentukan pusat dan jejari bagi bulatan yang mempunyai persamaan :

i) $(x - y)^2 + y^2 = 81$

[3 marks]

[3 markah]

ii) $x^2 + y^2 - 8x - 2y = 2$

[5 marks]

[5 markah]

(b) Determine the tangent and normal line equation to a circle with equation at the point (-3,5) on the circle.

Tentukan persamaan garis tangen dan garis normal kepada bulatan yang dimiliki oleh persamaan di titik (-3,5) pada bulatan tersebut.

[8 marks]

[8 markah]

- (c) Plot the parabola $(y - 4)^2 = 8(x - 3)$. Show clearly the vertex, the focus and the directrix of the parabola in the graph.

Lakarkan parabola $(y - 4)^2 = 8(x - 3)$. Tunjukkan dengan jelas verteks, titik fokus dan direktriks bagi parabola tersebut dalam graf tersebut

[9 marks]

[9 markah]

CLO4
C3**QUESTION 8**
SOALAN 8

- (a) Given an ellipse equation $9x^2 + 3y^2 = 81$. Calculate the focus point, major axis length, vertices and eccentricity of the ellipse. Then, sketch the ellipse.

Diberi persamaan elips $9x^2 + 3y^2 = 81$. Kirakan titik fokus, panjang paksi major, verteks dan esentriks elips tersebut. Kemudian, lakarkan elips tersebut.

[15 marks]

[15 markah]

- (b) Determine the centre, focus point, vertices, asymptotes and directrix for hyperbole:

Tentukan titik pusat, titik focus, vertex, asimptot dan direktriks untuk hiperbola :

$$\frac{x^2}{36} - \frac{y^2}{25} = 1$$

[10 marks]

[10 markah]

SECTION E

BAHAGIAN E :

INSTRUCTION:

Answer **ONE (1)** question from section **A, B or C** (for **JKE, JKP and JKPK**) and section **A, B or D** (for **JKM**).

ARAHAN:

Jawab SATU (1) soalan dari bahagian A, B atau C (untuk JKE, JKP dan JKPK) dan bahagian A, B atau D (untuk JKM).

SOALAN TAMAT



BA501 - ENGINEERING MATHEMATICS 4

Binomial Expansion

1.	$(a+x)^n = a^n + {}^nC_1 a^{n-1}x + {}^nC_2 a^{n-2}x^2 + {}^nC_r a^{n-r}x^r \dots \dots + x^n$	(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)
3.	The $(r+1)$ term = ${}^nC_r a^{n-r} x^r$	

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.	$\ln\left(\frac{m}{n}\right) = 2\left[\frac{m-n}{m+n} + \frac{1}{3}\left(\frac{m-n}{m+n}\right)^3 + \frac{1}{5}\left(\frac{m-n}{m+n}\right)^5 + \dots\right]$	
4.	$f(x) = f(0) + f'(0)x + \frac{f''(0)x^2}{2!} + \frac{f'''(0)x^3}{3!} + \dots + \frac{f^n(0)x^n}{n!}$	(MACLAURIN)
5.	$f(x) = f(x_0) + f'(x_0)(x-x_0) + \frac{f''(x_0)(x-x_0)^2}{2!} + \frac{f'''(x_0)(x-x_0)^3}{3!} + \dots + \frac{f^n(x_0)(x-x_0)^n}{n!}$	(TAYLOR)

Vector & Scalar

1.	Unit Vector, $\hat{u} = \frac{\bar{u}}{ u }$	2.	$\cos\theta = \frac{\bar{A} \bullet \bar{B}}{ A B }$	3.	$\vec{A} \bullet \vec{B} = a_1a_2 + b_1b_2 + c_1c_2$
4.	$\bar{A} \times \bar{B} = \begin{pmatrix} i & j & k \\ a_1 & b_1 & c_1 \\ a_2 & b_2 & c_2 \end{pmatrix}$	5.	Scalar triple product = $\equiv \mathbf{a} \bullet (\mathbf{b} \times \mathbf{c})$	6.	Volume of parallelepiped $a \times (b \times c) = b(a \bullet c) - c(a \bullet b)$
7.	Area of parallelogram ABC $ \bar{AB} \times \bar{BC} $				

Laplace Transform

No.	$f(t)$	$F(s)$	No.	$f(t)$	$F(s)$
1.	a	$\frac{a}{s}$	13.	$e^{-at} \sin \omega t$	$\frac{\omega}{(s+a)^2 + \omega^2}$
2.	at	$\frac{a}{s^2}$	14.	$e^{-at} \cos \omega t$	$\frac{s+a}{(s+a)^2 + \omega^2}$
3.	t^n	$\frac{n!}{s^{n+1}}$	15.	$\sinh \omega t$	$\frac{\omega}{s^2 - \omega^2}$
4.	e^{at}	$\frac{1}{s-a}$	16.	$\cosh \omega t$	$\frac{s}{s^2 - \omega^2}$
5.	e^{-at}	$\frac{1}{s+a}$	17.	$e^{at} \sinh \omega t$	$\frac{\omega}{(s-a)^2 - \omega^2}$
6.	te^{-at}	$\frac{1}{(s+a)^2}$	18.	$e^{-at} \sinh \omega t$	$\frac{\omega}{(s+a)^2 - \omega^2}$
7.	$t^n \cdot e^{at}, n=1,2,3$	$\frac{n!}{(s-a)^{n+1}}$	19.	$e^{-at} \cosh \omega t$	$\frac{s+a}{(s+a)^2 - \omega^2}$
8.	$t^n \cdot f(t)$	$(-1)^n \frac{d^n}{ds^n} [F(s)]$	20.	$f_1(t) + f_2(t)$	$F_1(s) + F_2(s)$
9.	$\sin \omega t$	$\frac{\omega}{s^2 + \omega^2}$	21.	$\int_0^t f(u) du$	$\frac{F(s)}{s}$
10.	$\cos \omega t$	$\frac{s}{s^2 + \omega^2}$	22.	$f(t-a)u(t-a)$	$e^{-as} F(s)$
11.	$t \sin \omega t$	$\frac{2\omega s}{(s^2 + \omega^2)^2}$	23.	First derivative $\frac{dy}{dt}, y'(t)$	$sY(s) - y(0)$
12.	$t \cos \omega t$	$\frac{s^2 - \omega^2}{(s^2 + \omega^2)^2}$	24.	Second derivative $\frac{d^2 y}{dt^2}, y''(t)$	$s^2 Y(s) - sy(0) - y'(0)$

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 , $y - y_1 = m(x - x_1)$	$m_{\text{tangent}} = -\frac{(x+g)}{(y+f)}$

PARABOLA

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

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

PARABOLA

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

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

ELLIPSE

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

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

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	$\frac{(x - h)^2}{a^2} + \frac{(y - k)^2}{b^2} = 1$ $a > b \quad \text{and} \quad b^2 = a^2 - c^2$		$\frac{(x - h)^2}{b^2} + \frac{(y - k)^2}{a^2} = 1$ $a > b \quad \text{and} \quad b^2 = a^2 - c^2$	
Directrices	$x = h \pm \frac{a^2}{c}$		$y = k \pm \frac{a^2}{c}$	

HYPERBOLA

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

Transverse axis	x - axis		y - axis	
Foci	$(c, 0)$	$(-c, 0)$	$(0, c)$	$(0, -c)$
Vertices	$(a, 0)$	$(-a, 0)$	$(0, a)$	$(0, -a)$
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	$y = \frac{b}{a}x$	$y = -\frac{b}{a}x$	$y = \frac{a}{b}x$	$y = -\frac{a}{b}x$
Directrix	$x = \frac{a}{e}$	$x = -\frac{a}{e}$	$y = \frac{a}{e}$	$y = -\frac{a}{e}$

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	$y - k = \frac{b}{a}(x - h)$	$y - k = -\frac{b}{a}(x - h)$	$y - k = \frac{a}{b}(x - h)$	$y - k = -\frac{a}{b}(x - h)$
Directrix	$x = h + \frac{a}{e}$	$x = h - \frac{a}{e}$	$y = k + \frac{a}{e}$	$y = k - \frac{a}{e}$

Differentiation
$\frac{d}{dx}(k) = 0, k = \text{constant}$
$\frac{d}{dx}(x^n) = nx^{n-1}$
$\frac{d}{dx}(\ln u) = \frac{1}{u} \frac{du}{dx}$
$\frac{d}{dx}(e^u) = e^u \frac{du}{dx}$
$\frac{d}{dx}(\cos u) = -\sin u \frac{du}{dx}$
$\frac{d}{dx}(\sin u) = \cos u \frac{du}{dx}$
$\frac{d}{dx}(\tan u) = \sec^2 u \frac{du}{dx}$
$\frac{d}{dx}(\cot u) = -\operatorname{cosec}^2 u \frac{du}{dx}$
$\frac{d}{dx}(\sec u) = \sec u \tan u \frac{du}{dx}$
$\frac{d}{dx}(\operatorname{cosec} u) = -\operatorname{cosec} u \cot u \frac{du}{dx}$

