SULIT

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 : 2024/2025

DBM30043 : ELECTRICAL ENGINEERING MATHEMATICS

TARIKH : 16 MEI 2025
MASA : 8.30 PAGI - 10.30 PAGI (2 JAM)

Kertas ini mengandungi **LAPAN (8)** 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 struktur. Jawab **SEMUA** soalan.*

QUESTION 1

SOALAN 1

CLO1 (a) Table 1(a) shows the distribution of monthly electricity consumption of 50 consumers in a locality.

Jadual 1(a) menunjukkan taburan penggunaan bulanan elektrik bagi 50 orang pengguna di dalam sebuah lokaliti.

Table 1(a) / *Jadual 1(a)*

Monthly consumption (in unit) *Penggunaan bulanan (dalam unit)*	Number of consumers *Jumlah pengguna*
81 - 90	10
91 - 100	9
101 - 110	15
111 - 120	10
121 - 130	6

Based on the table, calculate:

Berdasarkan jadual, kirakan:

i. Mode

Mod

[4 marks]
[*4 markah*]

ii. Variance

Varian

[6 marks]
[*6 markah*]

CLO1 (b) Given a set of data 3, 7, 6, 12, 8, 4, x and 12. Calculate the value of:
Diberi satu set data 3, 7, 6, 12, 8, 4, x dan 12. Kira nilai bagi:

i. x, if mean is 8
x, jika min adalah 8

[3 marks]
[*3 markah*]

ii. Standard deviation
Sisihan piawai

[5 marks]
[*5 markah*]

CLO1 (c) A drawer contains 5 white shirts, 8 black shirts and 9 yellow shirts. Two shirts are selected at random without replacement. Determine the probability of choosing:
Sebuah laci mengandungi 5 helai baju berwarna putih, 8 helai baju berwarna hitam dan 9 helai baju berwarna kuning. Dua helai baju dipilih secara rawak tanpa diganti. Tentukan kebarangkalian memilih:

i. Shirts with the same colour
Kemeja yang berwarna sama

[4 marks]
[*4 markah*]

ii. Shirts that have the combination of white and black colour
Kemeja yang mempunyai gabungan warna putih dan hitam

[3 marks]
[*3 markah*]

QUESTION 2

SOALAN 2

CLO1 (a) Based on the linear equations below:

Berdasarkan persamaan linear di bawah:

$$2x - y - 2z = -1$$

$$-4x + 6y = 13 - 3z$$

$$-4x - 2y + 8z = -6$$

i. Construct Matrix L and Matrix U using the Crout method

Bina Matriks L dan U menggunakan Kaedah Crout

[10 marks]

[*10 markah*]

ii. Then, calculate value of x, y and z

Kemudian, kira nilai x, y dan z

[8 marks]

[*8 markah*]

CLO1 (b) By using the Newton Raphson Method, determine the root for the function $f(x) = x^4 - x - 10$ correct to 3 decimal places. Given that $x_0 = 2.5$.

Dengan menggunakan Kaedah Newton Raphson, tentukan fungsi bagi $f(x) = x^4 - x - 10$ *tepat kepada 3 tempat perpuluhan. Diberi* $x_0 = 2.5$.

[7 marks]

[*7 markah*]

QUESTION 3

SOALAN 3

CLO1 (a) Express the order and degree of the following differential equations:

Nyatakan peringkat dan darjah bagi persamaan pembezaan yang berikut:

i. $4\left(\frac{d^3y}{dx^3}\right) - \left(\frac{d^2y}{dx^2}\right)^3 + 5\frac{dy}{dx} + 4 = 0$

[2 marks]
[*2 markah*]

ii. $\left(\frac{d^4y}{dx^4}\right)^2 + \left(\frac{dy}{dx}\right) - \cos^3 x = 0$

[2 marks]
[*2 markah*]

CLO1 (b) Solve the following differential equations by applying the method stated:

Selesaikan persamaan berikut dengan menggunakan kaedah yang dinyatakan:

i. $\frac{dy}{dx} = e^{5x} - 4x + 3$; Direct Integration
; *Pengamiran langsung*

[5 marks]
[*5 markah*]

ii. $\frac{dy}{dx} + \frac{y}{x} = x^2$; Integrating factors
; *Faktor Pengamiran*

[6 marks]
[*6 markah*]

CLO1 (c) Determine the general solution for the following differential equations:

Tentukan penyelesaian am bagi persamaan pembezaan berikut:

i. $2\frac{d^2y}{dx^2} - 3\frac{dy}{dx} = 2y$

[5 marks]
[*5 markah*]

ii. $\frac{d^2y}{dx^2} + 7y = 3\frac{dy}{dx}$

[5 marks]
[*5 markah*]

QUESTION 4

SOALAN 4

CLO1 (a) Determine the Laplace Transform for $f(t) = 2e^{3t}$ by using the definition of Laplace Transform, $F(s) = \int_0^\infty e^{-st} f(t)\, dt$.

Tentukan Jelmaan Laplace bagi fungsi $f(t) = 2e^{3t}$ *dengan menggunakan definisi Jelmaan Laplace,* $F(s) = \int_0^\infty e^{-st} f(t)\, dt$.

[5 marks]
[*5 markah*]

CLO1 (b) Calculate the Laplace Transform for the following functions by using the methods stated:

Kirakan Jelmaan Laplace bagi fungsi di bawah dengan menggunakan kaedah yang dinyatakan:

i. $\mathcal{L}\{10 + 3\cosh 6t - 4t^2\}$; Table of Laplace Transform
; *Jadual Jelmaan Laplace*

[3 marks]
[*3 markah*]

ii. $\mathcal{L}\{e^{-7t} \sin 3t\}$; First Shift Theorem
; *Teorem Anjakan Pertama*

[3 marks]
[*3 markah*]

iii. $\mathcal{L}\{te^{2t}\}$; Multiplication with t^n
; *Pendaraban dengan* t^n

[4 marks]
[*4 markah*]

CLO1 (c) Determine the Inverse Laplace Transform for the following functions by using the methods stated:

Tentukan Jelmaan Laplace Songsang bagi fungsi – fungsi yang berikut dengan menggunakan kaedah yang dinyatakan:

i. $F(s) = \frac{3s}{s^2+4} + \frac{4}{2s-10}$; Table of Laplace Transform
; *Jadual Jelmaan Laplace*

[3 marks]
[*3 markah*]

ii. $F(s) = \frac{1}{s(s-2)}$; Partial Fraction Method
; *Kaedah Pecahan Separa*

[7 marks]
[*7 markah*]

SOALAN TAMAT

FORMULA DBM30043 - ELECTRICAL ENGINEERING MATHEMATICS

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

NUMERICAL METHOD

Crout Method	$A = \begin{pmatrix} l_{11} & 0 & 0 \\ l_{21} & l_{22} & 0 \\ l_{31} & l_{32} & l_{33} \end{pmatrix} \begin{pmatrix} 1 & u_{12} & u_{13} \\ 0 & 1 & u_{23} \\ 0 & 0 & 1 \end{pmatrix}$	$Ly = b$ $Ux = y$
Doolittle Method	$A = \begin{pmatrix} 1 & 0 & 0 \\ l_{21} & 1 & 0 \\ l_{31} & l_{32} & 1 \end{pmatrix} \begin{pmatrix} u_{11} & u_{12} & u_{13} \\ 0 & u_{22} & u_{23} \\ 0 & 0 & u_{33} \end{pmatrix}$	
Newton Raphson Method	$x_{n+1} = x_n - \frac{f(x_n)}{f'(x_n)}$	
False Position Method	$x_0 = \frac{1}{y_2 - y_1} \begin{vmatrix} x_1 & y_1 \\ x_2 & y_2 \end{vmatrix}$	

PROBABILITY

$E = pn$	$P(A \cup B) = P(A) + P(B) - P(A \cap B)$
$P(B\|A) = \frac{P(B \cap A)}{P(A)}$	$P(A \cap B) = P(A) \bullet P(B)$
	$P(A \cup B) = P(A) + P(B)$
	$P(A \cap B) = P(A) \bullet P(B\|A)$

SOLUTION FOR 1st ORDER DIFFERENTIAL EQUATION

Logarithmic

$a = e^{\ln a}$

$a^x = e^{x \ln a}$

$\int a^x \, dx = \frac{a^x}{\ln a} + c$

Homogeneous Equation

$y = vx$ and $\frac{dy}{dx} = v + x\frac{dv}{dx}$

Linear Factors (Integrating Factors)

$\frac{dy}{dx} + Py = Q$

$y \bullet IF = \int Q \bullet IF \, dx$

Where $IF = e^{\int P \, dx}$

GENERAL SOLUTION FOR 2nd ORDER DIFFERENTIAL EQUATION

Equation of the form	$a\frac{d^2y}{dx^2} + b\frac{dy}{dx} + cy = 0$
Quadratics Formula	$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$
1. Real & different roots	$y = Ae^{m_1 x} + Be^{m_2 x}$
2. Real & equal roots	$y = e^{mx}(A + Bx)$
3. Complex roots	$y = e^{\alpha x}(A\cos\beta x + B\sin\beta x)$

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.	$t^n.e^{at}$, 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.	$t^n.f(t)$	$(-1)^n\frac{d^n}{ds^n}[F(s)]$	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 $\frac{d^2y}{dt^2}, y''(t)$	$s^2Y(s)-sy(0)-y'(0)$

DIFFERENTIATION			
1.	$\frac{d}{dx}(k) = 0\,,\quad k\ is\ constant$	2.	$\frac{d}{dx}(ax^n) = anx^{n-1}\quad [Power\ Rule]$
3.	$\frac{d}{dx}\big(f(x) \pm g(x)\big) = f'(x) \pm g'(x)$	4.	$\frac{d}{dx}(uv) = u\frac{dv}{dx} + v\frac{du}{dx}\quad [Product\ Rule]$
5.	$\frac{d}{dx}\left(\frac{u}{v}\right) = \frac{v\frac{du}{dx} - u\frac{dv}{dx}}{v^2}\quad [Quotient\ Rule]$	6.	$\frac{dy}{dx} = \frac{du}{dx} \times \frac{dy}{du}\quad [Chain\ Rule]$
7.	$\frac{d}{dx}(e^x) = e^x$	8.	$\frac{d}{dx}\left(e^{ax+b}\right) = e^{ax+b} \times \frac{d}{dx}(ax+b)$
9.	$\frac{d}{dx}(\ln\|x\|) = \frac{1}{x}$	10.	$\frac{d}{dx}[\ln\|ax+b\|] = \frac{1}{ax+b} \times \frac{d}{dx}(ax+b)$
11.	$\frac{d}{dx}(\sin x) = \cos x$	12.	$\frac{d}{dx}(\cos x) = -\sin x$
13.	$\frac{d}{dx}(\tan x) = \sec^2 x$	14.	$\frac{d}{dx}[\sin(ax+b)] = \cos(ax+b) \times \frac{d}{dx}(ax+b)$
15.	$\frac{d}{dx}[\cos(ax+b)] = -\sin(ax+b) \times \frac{d}{dx}(ax+b)$	16.	$\frac{d}{dx}[\tan(ax+b)] = sec^2(ax+b) \times \frac{d}{dx}(ax+b)$
17.	$\frac{d}{dx}[\sin^n u] = n\sin^{n-1} u \times \cos u \times \frac{du}{dx}$	18.	$\frac{d}{dx}[cos^n u] = n\,cos^{n-1} u \times -\sin u \times \frac{du}{dx}$
19.	$\frac{d}{dx}[tan^n u] = n\,tan^{n-1} u \times sec^2 u \times \frac{du}{dx}$		

INTEGRATION			
1.	$\int ax^n dx = \frac{ax^{n+1}}{n+1} + c\quad ;\{n \neq -1\}$	2.	$\int (ax+b)^n dx = \frac{(ax+b)^{n+1}}{(a)(n+1)} + c\ ;\{n \neq -1\}$
3.	$\int k\ dx = kx + c,\quad k\ is\ constant$	4.	$\int_a^b f(x)dx = F(b) - F(a)$
5.	$\int \frac{1}{x}\ dx = \ln\|x\| + c$	6.	$\int \frac{1}{ax+b}\ dx = \frac{1}{a} \times \ln\|ax+b\| + c$
7.	$\int e^x\ dx = e^x + c$	8.	$\int e^{ax+b}\ dx = \frac{1}{a} \times e^{ax+b} + c$
9.	$\int \sin x\ dx = -\cos x + c$	10.	$\int \cos x\ dx = \sin x + c$
11.	$\int sec^2 x\ dx = \tan x + c$		
12.	$\int \sin(ax+b)\ dx = -\frac{1}{a} \times \cos(ax+b) + c$		
13.	$\int \cos(ax+b)\ dx = \frac{1}{a} \times sin\,(ax+b) + c$		
14.	$\int sec^2(ax+b)\ dx = \frac{1}{a} \times \tan(ax+b) + c$		