

**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 DAN KOMPUTER**

**PEPERIKSAAN AKHIR**

**SESI I : 2023/2024**

**DBM30043: ELECTRICAL ENGINEERING MATHEMATICS**

**TARIKH : 20 DISEMBER 2023**

**MASA : 8.30 AM – 10.30 AM (2 JAM)**

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Kertas ini mengandungi **LAPAN (8)** halaman bercetak.

Struktur (4 soalan)

Dokumen sokongan yang disertakan : Formula

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**JANGAN BUKA KERTAS SOALAN INI SEHINGGA DIARAHKAN**

(CLO yang tertera hanya sebagai rujukan)

**SULIT**

**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) Table 1 shows the height of 75 students in a class.

*Jadual 1 menunjukkan ketinggian 75 orang pelajar di dalam sebuah kelas.*

Table 1 / *Jadual 1*

Height (cm) / <i>Ketinggian (cm)</i>	Frequency / <i>Kekerapan</i>
135 – 139	2
140 – 144	7
145 – 149	12
150 – 154	18
155 – 159	20
160 – 164	15
165 – 169	1

Based on the table, calculate:

*Berdasarkan jadual, kirakan:*

i. The mean height

*Min ketinggian*

[5 marks]

[5 markah]

ii. Mean deviation

*Sisihan min*

[5 marks]

[5 markah]

- CLO1 (b) Given data set 5, 7, 1, 2 and 4. Calculate:  
*Diberi set data 5, 7, 1, 2 dan 4. Kirakan:*
- i. Mean and median  
*Min dan Median*
- [4 marks]  
 [4 markah]
- ii. Mean deviation  
*Sisihan min*
- [4 marks]  
 [4 markah]
- CLO1 (c) In a selection of school-level speech participants, candidates will be voted by members of the Speech Club where a member can vote for a maximum of two candidates. The probability that Auni ( $A$ ) and Hani ( $H$ ) are voted to participate in the speech is  $\frac{5}{8}$  and  $\frac{1}{4}$  respectively.
- Dalam satu pemilihan peserta pidato peringkat sekolah, calon-calon akan diundi oleh ahli Kelab Pidato yang mana seorang ahli boleh mengundi maksimum dua orang calon. Kebarangkalian untuk Auni ( $A$ ) dan Hani ( $H$ ) diundi untuk menyertai pidato tersebut ialah masing-masing  $\frac{5}{8}$  dan  $\frac{1}{4}$*
- i. Calculate the probability of Auni or Hani being voted to participate in the speech competition.  
*Hitungkan kebarangkalian Auni atau Hani diundi untuk menyertai pertandingan pidato.*
- [4 marks]  
 [4 markah]
- ii. If the total number of votes is 64, calculate how many votes will be for other than Auni or Hani.  
*Sekiranya jumlah keseluruhan undian adalah 64, kirakan berapakah bilangan undian untuk selain daripada Auni atau Hani.*
- [3 marks]  
 [3 markah]

## QUESTION 2

## SOALAN 2

- CLO1 (a) Based on the following linear equations:  
*Berdasarkan persamaan linear di bawah;*

$$3x + 2y = 7 + 3z$$

$$2x - 4z = 6$$

$$x - 2y + 2z = 12$$

- i. Construct Matrix L and Matrix U by using Crout Method.

*Bina Matriks L dan Matriks U dengan menggunakan Kaedah Crout*

[10 marks]

[10 markah]

- ii. Calculate the value of  $x$ ,  $y$  and  $z$

*Kira nilai  $x$ ,  $y$  dan  $z$*

[8 marks]

[8 markah]

- CLO1 (b) Use the Fixed-Point Iteration Method to find the root for equation  $f(x) = x^3 - 7x + 2$  when  $x_0 = 2.5$ . Give your answer correct to 3 decimal places.

*Gunakan Kaedah Fixed-Point Iteration untuk mencari punca bagi persamaan  $f(x) = x^3 - 7x + 2$  bila  $x_0 = 2.5$ . Berikan jawapan anda tepat kepada 3 tempat perpuluhan.*

[7 marks]

[7 markah]

**QUESTION 3****SOALAN 3**

- CLO1 (a) Express the order and degree of the following differential equation:  
*Nyatakan peringkat dan darjah bagi persamaan pembezaan yang berikut:*

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

[2 marks]

[2 markah]

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

[2 marks]

[2 markah]

- CLO1 (b) Solve the following first order differential equations:  
*Selesaikan persamaan pembezaan peringkat pertama berikut:*

i.  $\frac{dy}{dx} = 7x^2 + 3 - \sin x$  ; Direct Integration

[5 marks]

[5 markah]

ii.  $5e^x \frac{dy}{dx} = y$  ; Separating the Variables

[6 marks]

[6 markah]

CLO1

(c) Solve the following second order differential equations:

*Selesaikan persamaan pembezaan peringkat kedua berikut:*

i. 
$$\frac{d^2y}{dx^2} + 9\frac{dy}{dx} + 20y = 0$$

[4 marks]

[4 markah]

ii. 
$$\frac{d^2y}{dx^2} - 6\frac{dy}{dx} + 12y = 0$$

[6 marks]

[6 markah]

## QUESTION 4

## SOALAN 4

- CLO1 (a) Use the definition of Laplace Transform,  $F(s) = \int_0^{\infty} e^{-st} f(t)dt$  to construct the Laplace Transform for  $f(t) = m e^{-3t}$  where  $m$  is any constant.
- Gunakan definisi Jelmaan Laplace,  $F(s) = \int_0^{\infty} e^{-st} f(t)dt$  untuk menghasilkan Jelmaan Laplace bagi  $f(t) = m e^{-3t}$  di mana  $m$  ialah sebarang pemalar.*
- [5 marks]  
[5 markah]
- CLO1 (b) Apply the stated theorem to find the Laplace Transforms for the following functions:
- Gunakan teorem yang dinyatakan untuk mencari Jelmaan Laplace bagi fungsi-fungsi berikut:*
- i.  $f(t) = t^5 + \cosh 2t$ ; Linearity Theorem  
 $f(t) = t^5 + \cosh 2t$ ; *Teorem Kelinearan*
- [3 marks]  
[3 markah]
- ii.  $g(t) = e^{3t} \sin 6t$ ; First Shift Theorem  
 $g(t) = e^{3t} \sin 6t$ ; *Teorem Anjakan Pertama*
- [3 marks]  
[3 markah]
- iii.  $k(t) = t e^{4t}$ ; Multiplication by  $t^n$  Theorem  
 $k(t) = t e^{4t}$ ; *Teorem Pendaraban dengan  $t^n$*
- [4 marks]  
[4 markah]

CLO1

(c) Solve each of the following using the specified method:

*Selesaikan setiap yang berikut menggunakan kaedah yang dinyatakan:*

i.  $\mathcal{L}^{-1}\left\{\frac{8}{(s-1)^2-4} + \frac{3s}{s^2+16}\right\}$ ; use the Table of Laplace Transforms

$\mathcal{L}^{-1}\left\{\frac{8}{(s-1)^2-4} + \frac{3s}{s^2+16}\right\}$ ; *gunakan Jadual Jelmaan Laplace*

[4 marks]

[4 markah]

ii.  $\mathcal{L}^{-1}\left\{\frac{2}{(s+1)(s+3)}\right\}$ ; use the Partial Fraction method

$\mathcal{L}^{-1}\left\{\frac{2}{(s+1)(s+3)}\right\}$ ; *gunakan kaedah Pecahan Separa*

[6 marks]

[6 markah]

**SOALAN TAMAT**



**FORMULA DBM30043 - ELECTRICAL ENGINEERING MATHEMATICS**

<b>DESCRIPTIVE STATISTICS</b>		
Number of class	<i>Sturges Rule, <math>k = 1 + 3.33 \log n</math></i>	<i>Rule of Thumb, <math>2^k &gt; n</math></i>
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	$D_k = L_{D_k} + \left( \frac{\frac{kN}{10} - F}{f_{D_k}} \right) C; \quad k = 1, 2, 3 \dots 9$	
Percentile	$P_k = L_{P_k} + \left( \frac{\frac{kN}{100} - F}{f_{P_k}} \right) C; \quad k = 1, 2, 3 \dots 99$	
Mean Deviation	$E = \frac{\sum  x - \bar{x} }{n}$	$E = \frac{\sum ( x - \bar{x}  f)}{\sum f}$
Variance	$s^2 = \frac{\sum (x - \bar{x})^2}{n}$	$s^2 = \frac{\sum_{i=1}^n x_i^2 - n\bar{x}^2}{n}$
	$s^2 = \frac{\sum [(x - \bar{x})^2 f]}{\sum f}$	$s^2 = \frac{\sum fx^2}{\sum f} - \left[ \frac{\sum fx}{\sum f} \right]^2$
Standard Deviation	$s = \sqrt{\text{variance}}$	

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		
$E = pn$	$P(A \cup B) = P(A) + P(B) - P(A \cap B)$	
$P(B A) = \frac{P(B \cap A)}{P(A)}$	$P(A \cap B) = P(A) \cdot P(B)$	
	$P(A \cup B) = P(A) + P(B)$	
	$P(A \cap B) = P(A) \cdot P(B A)$	
SOLUTION FOR 1 <sup>st</sup> ORDER DIFFERENTIAL EQUATION		
<b>Logarithmic</b> $a = e^{\ln a}$ $a^x = e^{x \ln a}$ $\int a^x dx = \frac{a^x}{\ln a} + c$	<b>Homogeneous Equation</b> $y = vx$ and $\frac{dy}{dx} = v + x \frac{dv}{dx}$	
	<b>Linear Factors (Integrating Factors)</b> $\frac{dy}{dx} + Py = Q$ $y \cdot IF = \int Q \cdot IF dx$ Where $IF = e^{\int P dx}$	
GENERAL SOLUTION FOR 2 <sup>nd</sup> ORDER DIFFERENTIAL EQUATION		
Equation of the form	$a \frac{d^2 y}{dx^2} + b \frac{dy}{dx} + cy = 0$	
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	$y = e^{m x} (A + Bx)$	
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.	$t^n \cdot e^{at}, n=1,2,3$	$\frac{n!}{(s-a)^{n+1}}$	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 $\frac{d^2y}{dt^2}, y''(t)$	$s^2Y(s) - sy(0) - y'(0)$

DIFFERENTIATION	
1. $\frac{d}{dx}(k) = 0, \quad k \text{ is constant}$	2. $\frac{d}{dx}(ax^n) = anx^{n-1} \quad [\text{Power Rule}]$
3. $\frac{d}{dx}(f(x) \pm g(x)) = f'(x) \pm g'(x)$	4. $\frac{d}{dx}(uv) = u \frac{dv}{dx} + v \frac{du}{dx} \quad [\text{Product Rule}]$
5. $\frac{d}{dx}\left(\frac{u}{v}\right) = \frac{v \frac{du}{dx} - u \frac{dv}{dx}}{v^2} \quad [\text{Quotient Rule}]$	6. $\frac{dy}{dx} = \frac{du}{dx} \times \frac{dy}{du} \quad [\text{Chain Rule}]$
7. $\frac{d}{dx}(e^x) = e^x$	8. $\frac{d}{dx}(e^{ax+b}) = e^{ax+b} \times \frac{d}{dx}(ax+b)$
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. $\int (ax+b)^n dx = \frac{(ax+b)^{n+1}}{(a)(n+1)} + c \quad ; \{n \neq -1\}$
3. $\int k dx = kx + c, \quad k \text{ is constant}$	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. $\int \sec^2(ax+b) dx = \frac{1}{a} \times \tan(ax+b) + c$	