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)

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 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) / *Ketinggian (cm)*	Frequency / *Kekerapan*
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 $\boldsymbol{f(t) = m\, e^{-3t}}$ where $\boldsymbol{m}$ is any constant.

Gunakan definisi Jelmaan Laplace, $F(s) = \int_0^\infty e^{-st} f(t)dt$ *untuk menghasilkan Jelmaan Laplace bagi* $\boldsymbol{f(t) = m\ e^{-3t}}$ *di mana* $\boldsymbol{m}$ *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. $k(t) = te^{4t}$; Multiplication by t^n Theorem

$k(t) = te^{4t}$; *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

DESCRIPTIVE 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	$s^2 = \frac{\sum (x - \bar{x})^2}{n}$	$s^2 = \frac{\sum_{i=1}^{n} x_i^2 - n\bar{x}^2}{n}$
	$s^2 = \frac{\sum [(x - \bar{x})^2 f]}{\sum f}$	$s^2 = \frac{\sum fx^2}{\sum f} - \left[\frac{\sum fx}{\sum f}\right]^2$
Standard Deviation	$s = \sqrt{variance}$	

<table>
<tr><th colspan="3">NUMERICAL METHOD</th></tr>
<tr><td>Crout Method</td><td>$A=\begin{pmatrix} l_{11} & 0 & 0 \\ l_{21} & l_{22} & 0 \\ l_{31} & l_{32} & l_{33} \end{pmatrix}\begin{pmatrix} 1 & u_{12} & u_{13} \\ 0 & 1 & u_{23} \\ 0 & 0 & 1 \end{pmatrix}$</td><td rowspan="2">$Ly = b$
$Ux = y$</td></tr>
<tr><td>Doolittle Method</td><td>$A=\begin{pmatrix} 1 & 0 & 0 \\ l_{21} & 1 & 0 \\ l_{31} & l_{32} & 1 \end{pmatrix}\begin{pmatrix} u_{11} & u_{12} & u_{13} \\ 0 & u_{22} & u_{23} \\ 0 & 0 & u_{33} \end{pmatrix}$</td></tr>
<tr><td>Newton Raphson Method</td><td colspan="2">$x_{n+1} = x_n - \dfrac{f(x_n)}{f'(x_n)}$</td></tr>
<tr><td>False Position Method</td><td colspan="2">$x_0 = \dfrac{1}{y_2 - y_1}\begin{vmatrix} x_1 & y_1 \\ x_2 & y_2 \end{vmatrix}$</td></tr>
<tr><th colspan="3">PROBABILITY</th></tr>
<tr><td colspan="2">$E = pn$</td><td>$P(A \cup B) = P(A) + P(B) - P(A \cap B)$</td></tr>
<tr><td colspan="2" rowspan="3">$P(B|A) = \dfrac{P(B \cap A)}{P(A)}$</td><td>$P(A \cap B) = P(A) \bullet P(B)$</td></tr>
<tr><td>$P(A \cup B) = P(A) + P(B)$</td></tr>
<tr><td>$P(A \cap B) = P(A) \bullet P(B|A)$</td></tr>
<tr><th colspan="3">SOLUTION FOR 1st ORDER DIFFERENTIAL EQUATION</th></tr>
<tr><td colspan="2">Logarithmic
$a = e^{\ln a}$
$a^x = e^{x \ln a}$
$\int a^x\,dx = \dfrac{a^x}{\ln a} + c$</td><td>Homogeneous Equation
$y = vx$ and $\dfrac{dy}{dx} = v + x\dfrac{dv}{dx}$
Linear Factors (Integrating Factors)
$\dfrac{dy}{dx} + Py = Q$
$y \bullet IF = \int Q \bullet IF\,dx$
Where $IF = e^{\int P\,dx}$</td></tr>
<tr><th colspan="3">GENERAL SOLUTION FOR 2nd ORDER DIFFERENTIAL EQUATION</th></tr>
<tr><td colspan="2">Equation of the form</td><td>$a\dfrac{d^2y}{dx^2} + b\dfrac{dy}{dx} + cy = 0$</td></tr>
<tr><td colspan="2">Quadratics Formula</td><td>$x = \dfrac{-b \pm \sqrt{b^2 - 4ac}}{2a}$</td></tr>
<tr><td colspan="2">1. Real & different roots</td><td>$y = Ae^{m_1 x} + Be^{m_2 x}$</td></tr>
<tr><td colspan="2">2. Real & equal roots</td><td>$y = e^{mx}(A + Bx)$</td></tr>
<tr><td colspan="2">3. Complex roots</td><td>$y = e^{\alpha x}(A\cos\beta x + B\sin\beta x)$</td></tr>
</table>

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.	$\frac{d}{dx}(k) = 0\,,\quad k \text{ is constant}$	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.	$\int k\ dx = kx + c,\quad k \text{ is constant}$	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.	$\int sec^2(ax+b)\ dx = \frac{1}{a} \times \tan(ax+b) + c$		