SULIT

BAHAGIAN PEPERIKSAAN DAN PENILAIAN
JABATAN PENDIDIKAN POLITEKNIK DAN KOLEJ KOMUNITI
KEMENTERIAN PENGAJIAN TINGGI

JABATAN MATEMATIK, SAINS & KOMPUTER

PEPERIKSAAN AKHIR

SESI I : 2022/2023

DBM30043 : ELECTRICAL ENGINEERING MATHEMATICS

TARIKH : 21 DISEMBER 2022
MASA : 8.30 AM – 10.30 AM (2 JAM)

Kertas ini mengandungi **TUJUH (7)** 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
C3

(a) Table 1(a) shows the total time spent for playing video games by 50 students of DAD3 for a period of 2 weeks.

Jadual 1(a) menunjukkan jumlah masa yang dihabiskan untuk bermain permainan video oleh 50 pelajar DAD3 untuk tempoh 2 minggu.

Table 1(a) /Jadual 1(a)

Total time(hours)/ *Masa(jam)*	0 -5	6-11	12-17	18-23	24-29	30-35	36-41
Number of student/ *Bilangan pelajar*	7	7	9	9	8	6	4

Based on the table, calculate:

Berdasarkan jadual, kirakan:

i. Mean

Min

[4 marks]

[*4 markah*]

ii. Standard Deviation

Sisihan Piawai

[6 marks]

[*6 markah*]

CLO1 C3

(b) Given a set of data 4, 7, 8, 9 and 10. Calculate the mean and median of the data if:
Diberi satu set data 4, 7, 8, 9 dan 10. Kirakan min dan median untuk data jika:

i. Add 2 to each of the original data
Tambahkan 2 pada setiap data

[4 marks]
[*4 markah*]

ii. Multiply each of the original data with 2
Darabkan dengan 2 bagi setiap data

[4 marks]
[*4 markah*]

CLO1 C3

(c) In a class of 30 students, 15 students like basketball, 14 students like football and 9 students like both basketball and football. Calculate the probability of a chosen person at random who likes:
Dalam sebuah kelas 30 orang pelajar, 15 pelajar sukakan bola keranjang, 14 orang pelajar sukakan bola sepak dan 9 orang pelajar suka kedua-keduanya. Kirakan kebarangkalian seorang yang dipilih secara rawak akan sukakan:

i. at least one of the games.
sekurang-kurangnya satu daripada permainan-permainan itu.

[4 marks]
[*4 markah*]

ii. basketball given that they like football.
bola keranjang diberi mereka sukakan bola sepak.

[3 marks]
[*3 markah*]

QUESTION 2

SOALAN 2

CLO1
C3

(a) Solve the linear equations below by using Gaussian elimination method.
Selesaikan persamaan linear di bawah menggunakan kaedah Penghapusan Gauss.

$$2x_1 - 2x_2 + 3x_3 = 3$$
$$4x_2 - 3x_3 = 3$$
$$3x_1 - 3x_2 + x_3 = -5$$

[7 marks]
[*7 markah*]

CLO1
C3

(b) Based on the following equations, determine matrix L and matrix U by using Doolittle Method.
Berdasarkan persamaan berikut, tentukan matrik L dan matrik U dengan menggunakan Kaedah Doolittle.

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

[8 marks]
[*8 markah*]

CLO1
C3

(c) Determine the real root for $f(x) = x^2 + 4x - 7$ by using Newton Raphson Method which lies between $x = 1$ and $x = 2$. Give the correct answer to 3 decimal places.
Tentukan punca persamaan bagi $f(x) = x^2 + 4x - 7$ *dengan menggunakan Kaedah Newton Raphson yang terletak di antara* $x = 1$ *dan* $x = 2$. *Beri jawapan tepat kepada 3 titik perpuluhan.*

[10 marks]
[*10 markah*]

QUESTION 3

SOALAN 3

CLO1 C2

(a) Express the differential equation for $y = 3Ax^2 + 2B$

Ungkapkan persamaan pembezaan bagi $y = 3Ax^2 + 2B$

[5 Marks]

[*5 Markah*]

CLO1 C3

(b) Solve the differential equation for the following:

Selesaikan persamaan pembezaan bagi yang berikut:

i. $\frac{dy}{dx} = \frac{y}{x} + \frac{3x}{y}$ (Using homogeneous)

[7 Marks]

[*7 Markah*]

ii. $\frac{dy}{dx} = \frac{2x^2 - x}{x}$ (Using direct integration)

[3 Marks]

[*3 Markah*]

CLO1 C3

(c) Determine the general solution for the differential equations below:

Tentukan penyelesaian umum bagi persamaan pembezaan berikut:

i. $2\frac{d^2y}{dx^2} - 5\frac{dy}{dx} - 3y = 0$

[4 Marks]

[*4 Markah*]

ii. $\frac{d^2y}{dx^2} = 4\frac{dy}{dx} - 13y$

[6 Marks]

[*6 Markah*]

QUESTION 4

SOALAN 4

CLO1 C3 (a) Compute the Laplace Transform by using the definition

$F(s) = \int_0^\infty e^{-st} f(t)\, dt$ for $f(t) = 5e^{3t}$.

Kirakan Jelmaan Laplace dengan menggunakan definisi

$F(s) = \int_0^\infty e^{-st} f(t)\, dt$ *bagi* $f(t) = 5e^{3t}$.

[5 marks]

[*5 markah*]

CLO1 C3 (b) Determine the Laplace Transform for:

Tentukan Jelmaan Laplace bagi:

i. $f(t) = 3t^4 + sin\ 4t - \frac{2}{e^{3t}} cosh\ 4t$ by using the Table of Laplace Transform.

$f(t) = 3t^4 + sin\ 4t - \frac{2}{e^{3t}} cosh\ 4t$ *dengan menggunakan Jadual Jelmaan Laplace.*

[5 marks]

[*5 markah*]

ii. $f(t) = 3e^{5t}t^2$ by using the Multiplication of t^n.

$f(t) = 3e^{5t}t^2$ *dengan menggunakan Pendaraban bagi* t^n.

[5 marks]

[*5 markah*]

CLO1
C3

(c) Determine the Inverse Laplace Transform for:

Tentukan Jelmaan Laplace Songsang bagi:

i. $F(s) = \frac{10}{(s+4)^2+25} - \frac{8}{(s-2)^5}$ by using the Table of Laplace Transform.

$F(s) = \frac{10}{(s+4)^2+25} - \frac{8}{(s-2)^5}$ *dengan menggunakan Jadual Jelmaan Laplace.*

[4 marks]

[*4 markah*]

ii. $F(s) = \frac{8s-42}{s^2+3s-18}$ by using Partial Fraction.

$F(s) = \frac{8s-42}{s^2+3s-18}$ *dengan menggunakan 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	$s = \sqrt{variance}$	

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	$x_{n+1} = x_n - \dfrac{f(x_n)}{f'(x_n)}$	
False Position Method	$x_0 = \dfrac{1}{y_2 - y_1}\begin{vmatrix} x_1 & y_1 \\ x_2 & y_2 \end{vmatrix}$	

PROBABILITY

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

SOLUTION FOR 1st ORDER DIFFERENTIAL EQUATION

Logarithmic

$a = e^{\ln a}$

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

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

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

GENERAL SOLUTION FOR 2nd ORDER DIFFERENTIAL EQUATION

Equation of the form	$a\dfrac{d^2y}{dx^2} + b\dfrac{dy}{dx} + cy = 0$
Quadratics Formula	$x = \dfrac{-b \pm \sqrt{b^2 - 4ac}}{2a}$
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.	$\int_o^t f(u)du$	$\frac{F(s)}{s}$
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.	$\frac{d}{dx}(ax^n) = anx^{n-1}$ [Power Rule]
3.	$\frac{d}{dx}\big(f(x) \pm g(x)\big) = f'(x) \pm g'(x)$	4.	$\frac{d}{dx}(uv) = u\frac{dv}{dx} + v\frac{du}{dx}$ [Product Rule]
5.	$\frac{d}{dx}\left(\frac{u}{v}\right) = \frac{v\frac{du}{dx} - u\frac{dv}{dx}}{v^2}$ [Quotient Rule]	6.	$\frac{dy}{dx} = \frac{du}{dx} \times \frac{dy}{du}$ [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.	$\int sec^2(ax+b)\ dx = \frac{1}{a} \times \tan(ax+b) + c$		