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 II : 2025/2026

DBM30193: ELECTRICAL ENGINEERING MATHEMATICS

TARIKH : 29 APRIL 2026
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. Answers **ALL** questions.

ARAHAN:

*Bahagian ini mengandungi **EMPAT (4)** soalan struktur. Jawab **SEMUA** soalan.*

QUESTION 1

SOALAN 1

CLO 1 (a) Table 1(a) shows the sales of a type of T-shirt produced by a particular factory.
Jadual 1(a) menunjukkan jualan bagi sejenis kemeja-T yang dihasilkan oleh kilang tertentu.

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

Size *Saiz*	4	6	8	10	12
Frequency, f *Frequency, f*	27	20	24	30	25

Calculate :

Kira :

i. mode

mod

[2 marks]

[*2 markah*]

ii. median

median

[4 marks]

[*4 markah*]

iii. mean

min

[4 marks]

[*4 markah*]

CLO 2 (b) Table 1(b) shows the distribution of time taken to assemble a mechanical component by a sample of 50 engineering students in a workshop.
Jadual 1(b) menunjukkan taburan masa yang diambil untuk memasang satu komponen mekanikal oleh 50 orang pelajar kejuruteraan di sebuah bengkel.

Table 1(b) / *Jadual 1(b)*

Time Taken (minutes) *Masa (minit)*	Frequency *Kekerapan*
10 – 14	4
15 – 19	6
20 – 24	12
25 – 29	15
30 – 34	8
35 – 39	5

Based on the table, calculate:
Berdasarkan jadual, kirakan:

i. mean
min

[4 marks]
[*4 markah*]

ii. variance
varians

[6 marks]
[6 *markah*]

CLO 2 (c) In an engineering laboratory, two production machines are used to manufacture electronic components. The probability that Machine R produces a component that meets the quality specification is $\frac{3}{4}$, while the probability that Machine A produces a component that meets the quality specification is $\frac{2}{3}$. One component is randomly selected from each machine. Calculate the probability that only one component meets the quality specification.

Di sebuah makmal kejuruteraan, dua mesin pengeluaran digunakan untuk menghasilkan komponen elektronik. Kebarangkalian Mesin R menghasilkan komponen yang memenuhi spesifikasi kualiti ialah $\frac{3}{4}$, *manakala kebarangkalian Mesin A menghasilkan komponen yang memenuhi spesifikasi kualiti ialah* $\frac{2}{3}$. *Pilih satu komponen secara rawak daripada setiap mesin. Kirakan kebarangkalian bahawa hanya satu komponen memenuhi spesifikasi.*

[5 marks]

[*5 markah*]

CLO 2

QUESTION 2

SOALAN 2

CLO 2 (a) Based on the following linear equations:

Berdasarkan persamaan linear di bawah:

$$x + 3y + 3z = -1$$
$$2x + 4y = 2 - 3z$$
$$3x + 5y + 4z = 3$$

i. construct Matrix L and Matrix U using the Doolittle Method.

bina Matriks L dan Matriks U menggunakan Kaedah Doolitle.

[10 marks]

[*10 markah*]

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

kira nilai x, y dan z.

[8 marks]

[*8 markah*]

CLO 1 (b) Use the Fixed-Point Iteration Method to find the root of the equation $f(x) = x^3 - 7x + 2$ given that $x_0 = 2.5$. Give your answer to 3 decimal places.

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

[7 marks]

[*7 markah*]

QUESTION 3

SOALAN 3

CLO 2 (a) Solve the following differential equations using the methods stated:

Selesaikan persamaan berikut dengan menggunakan kaedah yang dinyatakan:

i. $\frac{dy}{dx} = e^{8x+5}$; Direct Integration

; *Pengamiran Langsung*

[5 marks]

[*5 markah*]

ii. $\frac{dy}{dx} = (x-1)(2+y)$; Separating Variables

; *Memisahkan Pembolehubah*

[5 marks]

[*5 markah*]

iii. $\frac{dy}{dx} + 6y = e^{2x}$; Integrating Factors

; *Factor Pengamiran*

[5 marks]

[*5 markah*]

CLO 1 (b) Solve the following second order differential equations below:

Selesaikan persamaan pembezaan peringkat kedua di bawah:

i. $y'' + 4y' = 21y$

[4 marks]

[*4 markah*]

ii. $3y'' + 4y' + 2y = 0$

[6 marks]

[*6 markah*]

QUESTION 4

SOALAN 4

CLO 1 (a) Calculate the Laplace Transform for the following functions using the methods stated:

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

i. $\mathcal{L}\{12 - 3t^2\}$; Table of Laplace Transform
; Jadual Jelmaan Laplace

[3 marks]

[*3 markah*]

ii. $\mathcal{L}\{e^{5t}\sin 2t\}$; First Shift Theorem
; Teorem Anjakan Pertama

[3 marks]

[*3 markah*]

iii. $\mathcal{L}\{te^{3t}\}$; Multiplication with t^n
;Pendaraban dengan t^n

[4 marks]

[*4 markah*]

CLO 2 (b) Solve each of the following using the specified methods :

Selesaikan setiap yang berikut menggunakan kaedah yang dinyatakan:

i. $\mathcal{L}^{-1}\left\{\frac{10}{(s+4)^2+25}\right\}$; Table of Laplace Transform

; Jadual Jelmaan Laplace

[4 marks]

[*4 markah*]

ii. $\mathcal{L}^{-1}\left\{\frac{4}{2s-10}+\frac{3s}{s^2+4}\right\}$; Table of Laplace Transform

; Jadual Jelmaan Laplace

[5 marks]

[*5 markah*]

iii. $\mathcal{L}^{-1}\left\{\frac{6}{(s+1)(s+3)}\right\}$; Partial Fraction Method

; Kaedah Pecahan Separa

[6 marks]

[*6 markah*]

SOALAN TAMAT

FORMULA DBM30193 - ELECTRICAL ENGINEERING MATHEMATICS

DESCRIPTIVE STATISTICS		
Mean	$\overline{x} = \frac{\sum x}{n}$	$\overline{x} = \frac{\sum(fx)}{\sum f}$
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	$E = \frac{\sum\lvert x - \overline{x}\rvert}{n}$	$E = \frac{\sum(\lvert x - \bar{x}\rvert f)}{\sum f}$
Variance	$s^2 = \frac{\sum(x - \overline{x})^2}{n}$	$s^2 = \frac{\sum_{i=l}^{n} {x_i}^2 - n\overline{x}^2}{n}$
	$s^2 = \frac{\sum[(x - \overline{x})^2 f]}{\sum f}$	$s^2 = \frac{\sum fx^2}{\sum f} - \left[\frac{\sum fx}{\sum f}\right]^2$
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	$x_{n+1} = x_n - \frac{f(x_n)}{f'(x_n)}$	
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)

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

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

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. 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.	$\boldsymbol{a}$	$\boldsymbol{\frac{a}{s}}$	13.	$\boldsymbol{e^{-at}}\ sin\ \omega t$	$\boldsymbol{\frac{\omega}{(s+a)^2+\omega^2}}$
2.	$\boldsymbol{at}$	$\boldsymbol{\frac{a}{s^2}}$	14.	$\boldsymbol{e^{-at}}cos\ \omega t$	$\boldsymbol{\frac{s+a}{(s+a)^2+\omega^2}}$
3.	$\boldsymbol{t^n}$	$\boldsymbol{\frac{n!}{s^{n+1}}}$	15.	$\sinh \omega t$	$\boldsymbol{\frac{\omega}{s^2-\omega^2}}$
4.	$\boldsymbol{e^{at}}$	$\boldsymbol{\frac{1}{s-a}}$	16.	$\cosh \omega t$	$\boldsymbol{\frac{s}{s^2-\omega^2}}$
5.	$\boldsymbol{e^{-at}}$	$\boldsymbol{\frac{1}{s+a}}$	17.	$\boldsymbol{e^{at}}\ sinh\ \omega t$	$\boldsymbol{\frac{\omega}{(s-a)^2-\omega^2}}$
6.	$\boldsymbol{te^{-at}}$	$\boldsymbol{\frac{1}{(s+a)^2}}$	18.	$\boldsymbol{e^{-at}}\ sinh\ \omega t$	$\boldsymbol{\frac{\omega}{(s+a)^2-\omega^2}}$
7.	$t^n.e^{at}, n = 1,2,3$	$\frac{n!}{(s-a)^{n+1}}$	19.	$\boldsymbol{e^{-at}}\ cosh\ \omega t$	$\boldsymbol{\frac{s+a}{(s+a)^2-\omega^2}}$
8.	$t^n.f(t)$	$(-1)^n \frac{d^n}{ds^n}[F(s)]$	20.	$\boldsymbol{f_1(t)+f_2(t)}$	$\boldsymbol{F_1(s)+F_2(s)}$
9.	$sin\ \omega t$	$\boldsymbol{\frac{\omega}{s^2+\omega^2}}$	21.	$\boldsymbol{\int_0^t f(u)\,du}$	$\boldsymbol{\frac{F(s)}{s}}$
10.	$cos\ \omega t$	$\boldsymbol{\frac{s}{s^2+\omega^2}}$	22.	$\boldsymbol{f(t-a)u(t-a)}$	$\boldsymbol{e^{-as}F(s)}$
11.	$t\ sin\ \omega t$	$\boldsymbol{\frac{2\omega s}{(s^2+\omega^2)^2}}$	23.	First derivative $\boldsymbol{\frac{dy}{dt}}, \boldsymbol{y'(t)}$	$\boldsymbol{sY(s)-y(0)}$
12.	$t\ cos\ \omega t$	$\boldsymbol{\frac{s^2-\omega^2}{(s^2+\omega^2)^2}}$	24.	Second derivative $\boldsymbol{\frac{d^2y}{dt^2}}, \boldsymbol{y''(t)}$	$\boldsymbol{s^2Y(s)-sy(0)-y'(0)}$

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

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