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 I : 2025/2026

DBM30183 : MATHEMATICS ENGINEERING 3

TARIKH : 24 NOVEMBER 2025
MASA : 8.30 PAGI - 10.30 PAGI (2 JAM)

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

Struktur (4 soalan)

Dokumen sokongan yang disertakan : Kertas Graf dan 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) Based on the data given:

Berdasarkan data yang diberi:

$$5,\ 7,\ 10,\ 11,\ (2x+3)$$

i. Calculate the value x, if the mean of the data is 10.

Kira nilai x, jika min data adalah 10.

[2 marks]

[*2 markah*]

ii. Then, compute the median of the data.

Setelah itu, hitung nilai median bagi data tersebut.

[3 marks]

[*3 markah*]

iii. Calculate the standard deviation.

Kira sisihan piawai.

[5 marks]

[*5 markah*]

CLO2 (b) A group of Engineering students conducted an experiment to measure the electric consumption of industrial motors over one hour of operation. The data below shows the energy usage for 50 electric motors:

Sekumpulan pelajar Kejuruteraan telah menjalankan satu eksperimen bagi mengukur penggunaan tenaga motor industri dalam tempoh satu jam operasi. Data di bawah menunjukkan penggunaan tenaga bagi 50 buah motor elektrik:

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

Electric Consumption (kWh) *Penggunaan Elektrik (kWh)*	Number of Motors *Bilangan Motor*
10 - 14	6
15 - 19	7
20 - 24	14
25 - 29	12
30 - 34	8
35 - 39	3

Calculate:

Kira:

i. Mean

Min.

[5 marks]

[*5 markah*]

ii. Median

Median.

[5 marks]

[*5 markah*]

CLO2 (c) A circuit board contains 20 capacitors, and 4 of them are defective. If 3 capacitors are selected at random **without replacement**, calculate the probability that all selected capacitors are non-defective.

*Sebuah papan litar mengandungi 20 kapasitor, dan 4 daripadanya rosak. Jika 3 kapasitor dipilih secara rawak **tanpa gantian**, kira kebarangkalian semua kapasitor yang dipilih masih baik.*

[5 marks]

[*5 markah*]

QUESTION 2

SOALAN 2

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

Berdasarkan persamaan linear yang berikut:

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

i. Calculate matrix L and U by using the Crout Method.

Kirakan matriks L dan U menggunakan Kaedah Crout.

[10 marks]

[*10 markah*]

ii. Then, compute the value of *x, y* and *z.*

Kemudian, hitung nilai x, y dan z.

[8 marks]

[*8 markah*]

CLO 1 (b) Calculate the roots of the equation $x^4 - 5x^3 + 9x + 3 = 0$ correct to **3 decimal places** by using the Newton Raphson Method. Given that $x_0 = 5$.

Kirakan punca bagi persamaan $x^4 - 5x^3 + 9x + 3 = 0$ *betul kepada* ***3 tempat perpuluhan*** *menggunakan kaedah Newton Raphson. Diberi* $x_0 = 5$.

[7 marks]

[*7 markah*]

QUESTION 3

SOALAN 3

CLO2 (a) Calculate the following first order differential equations by using given method.
Kirakan persamaan pembezaan peringkat pertama berikut dengan menggunakan kaedah yang diberikan.

i. $\frac{dy}{dx} = 9x^2 + \frac{3}{x} - 5$; Direct Integration Method
; Kaedah Kamiran Terus

[3 marks]
[*3 markah*]

ii. $4x\frac{dy}{dx} = (y - 2)$; Separating the Variables Method
; Kaedah Pemisah Pemboleh Ubah

[4 marks]
[*4 markah*]

iii. $\frac{dy}{dx} = \frac{yx + y^2}{x^2}$; Homogeneous Method
; Kaedah homogen

[8 marks]
[*8 markah*]

CLO1 (b) Solve the following second order differential equations:
Selesaikan persamaan pembezaan peringkat kedua berikut:

i. $6\frac{d^2y}{dx^2} = 35y - 11\frac{dy}{dx}$

[5 marks]
[*5 markah*]

ii. $6\frac{d^2y}{dx^2} + 10y = 8\frac{dy}{dx}$

[5 marks]
[*5 markah*]

QUESTION 4

SOALAN 4

CLO1 (a) The maximum value of the objective function $Z = 4x + 6y$ where $x \geq 0$ and $y \geq 0$ subject to the following constraints:

Kirakan nilai maksimum fungsi objektif $Z = 4x + 6y$ *dimana* $x \geq 0$ *dan* $y \geq 0$ *tertakluk kepada kekangan:*

$$2x + y \leq 20$$
$$2x - y \geq 4$$
$$x - 2y \leq 2$$

i. Draw and shade the feasible region which fulfill the given condition by using the scale of 2 cm to 2 unit for both x -axis and y -axis.

Lukis dan lorek kawasan tersaur yang memenuhi syarat-syarat yang telah diberikan dengan menggunkan skala 2 cm untuk 2-unit bagi kedua-dua paksi x *dan* y.

[7 marks]

[*7 markah*]

ii. Based on the graph in (a) i, calculate the value of x and y to obtain the maximum value of objective function Z.

Berdasarkan graf (a) i, kirakan nilai x *dan* y *untuk memperolehi nilai maksimum bagi fungsi objektif* Z.

[3 marks]

[*3 markah*]

CLO2 (b) Given Linear Programming problem with maximize value of the objective function, $Z = 8x + 3y$ with given constraints:

Diberi permasalahan pengaturcaraan linear dengan nilai maksimum bagi fungsi $Z = 8x + 3y$ *dengan kekangan yang telah diberikan dibawah:*

$$4x + 8y \leq 400$$
$$6x + 6y \leq 420$$
$$x, y \geq 0$$

i. Write the problem in Standard Simplex Form.
Tuliskan penyataan masalah dalam bentuk fungsi Simpleks Piawai.

[3 marks]
[*3 markah*]

ii. Based on the answer (b) i, change the Standard Simplex Form to the First Initial Tableau.
Daripada jawapan (b) i, tukarkan persamaan bentuk Simpleks Piawai tersebut kepada Jadual Permulaan Tableau.

[2 marks]
[*2 markah*]

iii. Solve the First Initial Tableau to get the optimal solution.
Selesaikan Jadual Permulaan Tableau tersebut untuk mendapatkan penyelesaian optimum.

[10 marks]
[*10 markah*]

SOALAN TAMAT

FORMULA DBM30183 - ENGINEERING MATHEMATICS 3

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	$s = \sqrt{variance}$	

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

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	$x_0 = \dfrac{1}{y_2 - y_1} \begin{vmatrix} x_1 & y_1 \\ x_2 & y_2 \end{vmatrix}$	

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)** $\dfrac{dy}{dx} + Py = Q$ $y \cdot IF = \int Q \cdot IF \, dx$ Where $IF = e^{\int P \, dx}$
GENERAL SOLUTION FOR 2nd ORDER DIFFERENTIAL EQUATION	
Equation of the form	$a\dfrac{d^2y}{dx^2} + b\dfrac{dy}{dx} + cy = 0$
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. Complex roots	$y = e^{\alpha x}(A\cos \beta x + B\sin \beta x)$

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.	$\int sec^2(ax+b)\ dx = \frac{1}{a} \times \tan(ax+b) + c$		