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) The following table shows the distribution of loads which are supported by cable produced by a company.

Jadual berikut menunjukkan agihan bebanan yang disokong oleh kabel dikeluarkan oleh sebuah syarikat.

Table 1a: The distribution of loads

Jadual 1a: Agihan bebanan

Load (kilo Newtons) *Bebanan*	Frequency *Frekuensi*
80 - 84	3
85 - 89	12
90 - 94	14
95 - 99	9
100 - 104	7
105 - 109	5

Calculate :
Kirakan :

i. Mean
Min

[3 marks]
[*3 markah*]

ii. Mode
Mod

[3 marks]
[*3 markah*]

iii. Variance and standard deviation
Varians dan sisihan piawai

[9 marks]
[*9 markah*]

b) A box contains 4 white balls and 3 red balls. One ball is drawn randomly from the box without replacement.
Di dalam sebuah kotak terdapat 4 biji bola berwarna putih dan 3 biji bola berwarna merah. Bola itu diambil secara rawak tanpa dimasukkan semula ke dalam kotak tersebut.

i. Draw the Tree Diagram
Lukiskan gambarajah pokok

[2 marks]
[*2 markah*]

ii. Using the Tree Diagram, find the probability that:
Menggunakan gambarajah pokok, tentukan kebarangkalian bagi:

a. The first ball drawn is white and second ball is red
Bola pertama yang diambil adalah putih dan bola kedua adalah merah

[2 marks]
[*2 markah*]

b. Both balls are red
Kedua-dua bola bewarna merah

[2 marks]
[*2 markah*]

c. Both balls are same colour
Kedua-dua bola tersebut adalah sama warna

[4 marks]
[*4 markah*]

QUESTION 2

SOALAN 2

CLO1
C3

a) Solve the linear equations by using Crout Method.

Selesaikan persamaan berikut menggunakan Kaedah Crout.

$$5p - 3q + 2r = 1$$
$$2q + 3r = 2$$
$$-2p + 4r = 3$$

[15 marks]

[*15 markah*]

CLO1
C3

b) By using the Fixed-Point Iteration Method, solve equation $x^3 + 3x^2 - 1 = 0$. Give the answer correct to (3) three decimal places. Given $x_0 = 1$.

Dengan menggunakan Kaedah Lelaran Titik Mudah, selesaikan persamaan $x^3 + 3x^2 - 1 = 0$. *Berikan jawapan tepat kepada (3) tiga titik perpuluhan. Diberi* $x_0 = 1$.

[10 marks]

[*10 markah*]

QUESTION 3

SOALAN 3

CLO1 C3

a) Solve the following differential equations:

Selesaikan persamaan pembezaan berikut:

i. $\frac{dy}{dx}=\frac{5x^2}{3y^2+7}$

[5 marks]

[*5 markah*]

ii. $\frac{dy}{dx}+5y=e^{5x}$

[5 marks]

[*5 markah*]

CLO1 C3

b) Solve the following second order of differential equations:

Selesaikan persamaan pembezaan peringkat kedua berikut:

i. $\frac{d^2y}{dx^2}+10\frac{dy}{dx}+25y=0$

[4 marks]

[*4 markah*]

ii. $\frac{d^2y}{dx^2}-7\frac{dy}{dx}+12y=0$

[5 marks]

[*5 markah*]

iii. $\frac{d^2y}{dx^2}+8\frac{dy}{dx}+41y=0$

[6 marks]

[*6 markah*]

QUESTION 4

SOALAN 4

CLO1
C3

a) Determine the Laplace Transform for:

Tentukan Jelmaan Laplace bagi:

i. $f(t)=\frac{3}{5}$ by using the definition $F(s)=\int_0^\infty e^{-st}f(t)dt.$

$f(t)=\frac{3}{5}$ *dengan menggunakan definisi* $F(s)=\int_0^\infty e^{-st}f(t)dt.$

[6 marks]

[6 markah]

ii. $f(t)=7\cos 3t-3\sin 2t$ by using the Table of Laplace Transform.

$f(t)=7\cos 3t-3\sin 2t$ *dengan menggunakan Jadual Jelmaan Laplace*

[4 marks]

[4 markah]

iii. $f(t)=e^{4t}\sin 8t$ by using First Shift Theorem

$f(t)=e^{4t}\sin 8t$ *dengan menggunakan Teorem Anjakan Pertama*

[5 marks]

[5 markah]

CLO1
C3

(b) Determine the Inverse Laplace Transform of:

Tentukan Jelmaan Laplace Songsang yang berikut:

i. $F(s) = \frac{4}{s+9} - \frac{2}{s-5} + \frac{7}{s}$ by using Table of Laplace Transform

$F(s) = \frac{4}{s+9} - \frac{2}{s-5} + \frac{7}{s}$ *dengan menggunakan Jadual Laplace Transform*

[3 marks]

[*3 markah*]

ii. $F(s) = \frac{s^2+1}{s(s+1)(s-1)}$ by using partial fraction method.

$F(s) = \frac{s^2+1}{s(s+1)(s-1)}$ *dengan menggunakan kaedah pecahan separa.*

[7 marks]

[*7 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	$\bar{x} = \dfrac{\sum x}{n}$	$\bar{x} = \dfrac{\sum (fx)}{\sum f}$
Median	$Median = L_m + \left(\dfrac{\frac{N}{2} - F}{f_m}\right) C$	
Mode	$Mode = L_{M_o} + \left(\dfrac{d_1}{d_1 + d_2}\right) C$	
Quartile	$Q_k = L_{Q_k} + \left(\dfrac{\frac{kN}{4} - F}{f_{Q_k}}\right) C; \quad k = 1, 2, 3$	
Decile	$D_k = L_{D_k} + \left(\dfrac{\frac{kN}{10} - F}{f_{D_k}}\right) C; \quad k = 1, 2, 3 \ldots 9$	
Percentile	$P_k = L_{P_k} + \left(\dfrac{\frac{kN}{100} - F}{f_{P_k}}\right) C; \quad k = 1, 2, 3 \ldots 99$	
Mean Deviation	$E = \dfrac{\sum \lvert x - \bar{x} \rvert}{n}$	$E = \dfrac{\sum (\lvert x - \bar{x} \rvert f)}{\sum f}$
Variance	$s^2 = \dfrac{\sum (x - \bar{x})^2}{n}$	$s^2 = \dfrac{\sum_{i=1}^{n} x_i^2 - n\bar{x}^2}{n}$
	$s^2 = \dfrac{\sum [(x - \bar{x})^2 f]}{\sum f}$	$s^2 = \dfrac{\sum fx^2}{\sum f} - \left[\dfrac{\sum fx}{\sum f}\right]^2$
Standard Deviation	$s = \sqrt{variance}$	

NUMERICAL METHOD	
Crout Method	$A=\begin{pmatrix} l_{11} & 0 & 0 \\ l_{21} & l_{22} & 0 \\ l_{31} & l_{32} & l_{33} \end{pmatrix}\begin{pmatrix} 1 & u_{12} & u_{13} \\ 0 & 1 & u_{23} \\ 0 & 0 & 1 \end{pmatrix}$
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.	$\frac{d}{dx}(k) = 0\,,\quad k\ is\ constant$	2.	$\frac{d}{dx}(ax^n) = anx^{n-1}\quad [Power\ Rule]$
3.	$\frac{d}{dx}\left(f(x) \pm g(x)\right) = f'(x) \pm g'(x)$	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.	$\int k\ dx = kx + c,\quad k\ is\ constant$	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.	$\int sec^2(ax+b)\ dx = \frac{1}{a} \times \tan(ax+b) + c$		