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 II : 2022/2023

DBM30043: ELECTRICAL ENGINEERING MATHEMATICS

TARIKH : 08 JUN 2023
MASA : 11.15 PG – 01.15 PTG (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 struktur. Jawab **SEMUA** soalan.*

QUESTION 1

SOALAN 1

CLO1

(a) Table 1(a) shows the age distribution of participants registered for a computer class at Intel Corporation.

Jadual 1(a) menunjukkan taburan umur bagi peserta yang mendaftar untuk kelas komputer di Intel Corporation.

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

Age (Years)/ *Umur (Tahun)*	1-10	11-20	21-30	31-40	41-50	51-60	61-70
Number of participants/ *Jumlah peserta*	5	10	17	22	24	18	4

Based on the table, calculate:

Berdasarkan jadual, kirakan

i. First quartile

Kuartil pertama

[6 marks]

[*6 markah*]

ii. Third quartile

Kuartil ketiga

[4 marks]

[*4 markah*]

CLO1 (b) Given a set of data 1, 2, 5, 7, 8, 9, **x** and 11. Calculate:
*Diberi satu set data 1, 2, 5, 7, 8, 9, **x** dan 11. Kirakan:*

i. The mean of the data if mode is 9.
Min jika mod untuk data ialah 9.

[4 marks]
[*4 markah*]

ii. The median of the data if mode is 2.
Median jika mod untuk data ialah 2.

[4 marks]
[*4 markah*]

CLO1 (c) A number is selected at random from set $\{1, 2, 3, 4, 5, 6, 7, 8, 9\}$. Calculate:
Satu nombor telah dipilih daripada set $\{1, 2, 3, 4, 5, 6, 7, 8, 9\}$. *Kirakan:*

i. Probability of choosing odd numbers.
Kebarangkalian memilih nombor ganjil.

[3 marks]
[*3 markah*]

ii. Probability of choosing prime numbers given that the numbers are odd.
Kebarangkalian memilih nombor perdana diberi bahawa nombor tersebut adalah ganjil.

[4 marks]
[*4 markah*]

QUESTION 2

SOALAN 2

CLO1 (a) Given linear equations as below :

Diberi persamaan linear seperti di bawah :

$$x + 3y + z = 10$$
$$5y + 2z = 16$$
$$4x + y + 6z = 24$$

i. Write the equations in matrix form Ax = B.

Tuliskan persamaan tersebut dalam bentuk matriks Ax = B.

[2 marks]

[*2 markah*]

ii. Solve the linear equations by using Gaussian Elimination Method.

Selesaikan persamaan linear tersebut menggunakan Kaedah Penghapusan Gauss.

[16 marks]

[*16 markah*]

CLO1 (b) Determine the root for equation $2x^3 - 2x - 5 = 0$ correct to 3 decimal places by using Fixed Point Iteration Method. Given that $x_0 = 3$.

Tentukan punca bagi persamaan $2x^3 - 2x - 5 = 0$ *tepat kepada 3 tempat perpuluhan dengan menggunakan Kaedah Fixed Point. Diberi* $x_0 = 3$.

[7 marks]

[*7 markah*]

QUESTION 3

SOALAN 3

CLO1 (a) Identify the order and degree of the following equations.

Kenal pasti peringkat dan kuasa bagi persamaan berikut.

i. $xy\frac{d^2y}{dx^2} - y^4 \sin x = 0$

[2 marks]

[*2 markah*]

ii. $4\frac{d^3y}{dx^3} - 3y\left(\frac{dy}{dx}\right)^3 + e^{5x} = 0$

[2 marks]

[*2 markah*]

CLO1 (b) Solve the following differential equations by applying the given method.

Selesaikan persamaan berikut dengan menggunakan kaedah yang diberi.

i. $xy\frac{dy}{dx} = \frac{x^2+7}{y-3}$ (separating variables)

[5 marks]

[*5 markah*]

ii. $x\frac{dy}{dx} + y = x^3$ (integrating factors)

[6 marks]

[*6 markah*]

CLO1 (c) Determine the solution for the differential equations below:

Tentukan penyelesaian bagi persamaan pembezaan berikut:

i. $\frac{d^2y}{dx^2} - 6\frac{dy}{dx} + 8y = 0$

[4 marks]

[*4 markah*]

ii. $3\frac{d^2y}{dx^2} = -5\frac{dy}{dx} - 7y$

[6 marks]

[*6 markah*]

QUESTION 4

SOALAN 4

CLO1 (a) Determine the Laplace Transform for $f(t) = 5h$ by using the definition of Laplace Transform.

Tentukan Jelmaan Laplace bagi $f(t) = 5h$ *dengan menggunakan definisi Jelmaan Laplace*

$$F(s) = \int_0^{\infty} e^{-st} f(t) dt$$

[5 marks]

[*5 markah*]

CLO1 (b) Determine the Laplace Transform for the functions below by using Table of Laplace Transform.

Tentukan Jelmaan Laplace bagi fungsi di bawah dengan menggunakan Jadual Jelmaan Laplace.

i. $f(t) = 5e^{-2t} + 3t - 10$

[3 marks]

[*3 markah*]

ii. $f(t) = 2cos8t - 7t^2$

[3 marks]

[*3 markah*]

iii. $f(t) = -10e^{5t} sin3t - 2te^{7t} + 6sinh8t$

[4 marks]

[*4 markah*]

CLO1

(c) Determine the Inverse Laplace Transform for:
Cari Jelmaan Laplace Songsang bagi:

i. $F(s) = \frac{6}{s^4}$ by using Table of Laplace Transform.

[3 marks]
[*3 markah*]

ii. $F(s) = \frac{3}{(s+1)(s-2)}$ by using Partial Fraction

[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	$\bar{x} = \frac{\sum x}{n}$	$\bar{x} = \frac{\sum (fx)}{\sum f}$
Median	Median = $L_m + \left[\frac{\frac{N}{2} - F}{f_m}\right] C$	
Mode	Mode = $L_{Mo} + \left[\frac{d_1}{d_1 + d_2}\right] C$	
Quartile	$Q_k = L_{Q_k} + \left[\frac{\frac{kN}{4} - F}{f_{Q_k}}\right] C$; k = 1, 2, 3	
Decile	$D_k = L_{D_k} + \left[\frac{\frac{kN}{10} - F}{f_{D_k}}\right] C$; k = 1, 2, 3..... 9	
Percentile	$P_k = L_{P_k} + \left[\frac{\frac{kN}{100} - F}{f_{P_k}}\right] C$; k = 1, 2, 3 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	$s = \sqrt{\text{var}\,iance}$	

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

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

SOLUTION FOR 1st ORDER DIFFERENTIAL EQUATION	
Homogeneous Equation $y=vx$ and $\dfrac{dy}{dx}=v+x\dfrac{dv}{dx}$	**Linear Factors (Integrating Factors)** $y\bullet IF=\int Q\bullet IF\,dx$ Where $IF=e^{\int P\,dx}$
	Logarithmic $a=e^{\ln a}$ $a^x=e^{x\ln a}$ $\int a^x\,dx=\dfrac{a^x}{\ln a}+c$
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 roots2	$y=Ae^{m_1x}+Be^{m_2x}$
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.	$\frac{d}{dx}(k) = 0, k \text{ is constant}$	**2.**	$\frac{d}{dx}(x^n) = nx^{n-1}$ $[Power\ Rule]$
3.	$\frac{d}{dx}(ax^n) = anx^{n-1}$	**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.	$\int \sin(ax+b)\ dx = -\frac{1}{\frac{d}{dx}(ax+b)} \times \cos(ax+b) + c$		
13.	$\int \cos(ax+b)\ dx = \frac{1}{\frac{d}{dx}(ax+b)} \times sin\ (ax+b) + c$		
14.	$\int sec^2(ax+b)\ dx = \frac{1}{\frac{d}{dx}(ax+b)} \times \tan(ax+b) + c$		