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 II : 2023/2024

DBM30043: ELECTRICAL ENGINEERING MATHEMATICS

TARIKH : 10 JUN 2024
MASA : 8.30 PAGI – 10.30 PAGI (2 JAM)

Kertas ini mengandungi **SEMBILAN (9)** 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 (a) Table 1(a) below shows the marks obtained for 100 students in DEE3A.

Jadual 1(a) di bawah menunjukkan jumlah markah yang diperolehi oleh 100 pelajar DEE3A.

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

Marks *Markah*	Number of students *Bilangan pelajar*
55 - 59	5
60 - 64	15
65 - 69	20
70 - 74	25
75 - 79	30
80 - 84	5

Based on Table 1(a), calculate:

Berdasarkan Jadual 1(a), kirakan:

i. Mean

Min

[5 marks]

[*5 markah*]

ii. Median

Median

[5 marks]

[*5 markah*]

CLO1 (b) Given the mean of the data $(x-5), (x+5), (x-2), (3x-2), (2x+1)$ is 9.

Diberi min bagi set data $(x-5), (x+5), (x-2), (3x-2), (2x+1)$ *ialah 9.*

i. Calculate the value of x
Kirakan nilai x

[4 marks]
[*4 markah*]

ii. Then, determine the median and the mode of the data.
Kemudian, tentukan median dan mod bagi data tersebut.

[4 marks]
[*4 markah*]

CLO1 (c) i. A box contains 5 yellow pens, 5 blue pens and 6 red pens. Thalia picks a pen at random and its color is noted before she puts it back to the box. Then, a second pen is picked by her brother. Calculate the probability of getting the first picked is red pen and the second picked is yellow pen.

Sebuah kotak mempunyai 5 batang pen berwarna kuning, 5 batang pen berwarna biru dan 6 batang pen berwarna merah. Thalia memilih sebatang pensecara rawak dan mencatat warna tersebut sebelum meletakkannya kembali ke dalam kotak tersebut. Kemudian, pen kedua telah dipilih oleh adik beliau. Kirakan keberangkalian bahawa pilihan pertama ialah pen berwarna merah dan pilihan yang kedua ialah pen berwarna kuning.

[3 marks]
[*3 markah*]

ii. A letter is chosen at random from the word: **MATHEMATICS.** Calculate the probability of getting a consonant or a letter M.

Satu huruf dipilih secara rawak daripada perkataan MATHEMATICS. Kirakan kebarangkalian bahawa huruf yang dipilih adalah huruf konsonan atau huruf M.

[4 marks]
[*4 markah*]

QUESTION 2

SOALAN 2

CLO1 (a) Based on the following linear equations:

Berdasarkan persamaan linear yang berikut:

$$x - 3y = 8 - 2z$$
$$4x - y - z = 9$$
$$3x + 2y + z = 21$$

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

Kirakan matriks L dan U dengan menggunakan Kaedah Doolittle.

[10 marks]

[*10 markah*]

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

Kemudian, kirakan nilai x, y dan z.

[8 marks]

[*8 markah*]

CLO1 (b) Determine the roots for equation $x^4 - x = 10$ correct to 2 decimal places by using the Fixed-Point Iteration Method. Given that $x_0 = 1.75$.

Tentukan punca bagi persamaan $x^4 - x = 10$ *betul kepada 2 tempat perpuluhan dengan menggunakan kedah Fixed Point Iteration. Diberi* $x_0 = 1.75$.

[7 marks]

[*7 markah*]

QUESTION 3

SOALAN 3

CLO1 (a) Identify the order and degree of the following differential equation:

Kenalpasti peringkat dan darjah bagi persamaan pembezaan yang berikut:

i. $25\left(\frac{d^3y}{dx^3}\right) + \left(\frac{dy}{dx}\right)^4 = 6$

[2 marks]

[*2 markah*]

ii. $\left(\frac{d^2s}{dt^2}\right)^3 - 18\left(\frac{ds}{dt}\right)^2 = cos\, t$

[2 marks]

[*2 markah*]

CLO1 (b) Solve the first order differential equation of the following:

Selesaikan persamaan pembezaan peringkat pertama bagi yang berikut:

i. $y\frac{dy}{dx} = \frac{7x^3 + 1}{y}$; Separating the Variables

; *Pembolehubah Terpisah*

[5 marks]

[*5 markah*]

ii. $\frac{dy}{dx} + \frac{3y}{x} = 8x^2$; Integrating Factor

; *Faktor Pengamiran*

[6 marks]

[*6 markah*]

CLO1 (c) Solve the second order differential equation of the following:

Selesaikan persamaan pembezaan peringkat kedua bagi yang berikut:

i. $\frac{d^2y}{dx^2} - 7\frac{dy}{dx} - 30y = 0$

[5 marks]

[*5 markah*]

ii. $\frac{d^2y}{dx^2} + 18\frac{dy}{dx} + 90y = 2\frac{dy}{dx} + 26y$

[5 marks]

[*5 markah*]

QUESTION 4

SOALAN 4

CLO1 (a) Calculate $f(t) = e^{-4t}$ by using the definition of Laplace Transform, $F(s) = \int_0^\infty e^{-st} f(t)\, dt$.

Kirakan $f(t) = e^{-4t}$ *menggunakan definasi Jelmaan Laplace,* $F(s) = \int_0^\infty e^{-st} f(t)\, dt$.

[5 marks]

[*5 markah*]

CLO1 (b) Calculate the following Laplace Transform by using the stated method:

Kirakan Jelmaan Laplace berikut menggunakan kaedah yang dinyatakan:

i. $\mathcal{L}\{cos\, 4\, t - 2t^3 + 4e^{-2t}\}$; Table of Laplace Transform
; *Jadual Jelmaan Laplace*

[3 marks]

[*3 markah*]

ii. $\mathcal{L}\{e^{3t} \sinh 2t\}$; First Shift Theorem
; *Teorem Anjakan Pertama*

[3 marks]

[*3 markah*]

iii. $\mathcal{L}\{t^2 e^{6t}\}$; Multiplication with t^n
; *Pendaraban dengan* t^n

[4 marks]

[*4 markah*]

CLO1

(c) Solve the Inverse Laplace Transform by using the stated method:

Selesaikan Jelmaan Laplace Songsang yang berikut menggunakan kaedah yang dinyatakan:

i. $F(s) = \dfrac{8}{s^2 + 36}$; Table of Laplace Transform
; *Jadual Jelmaan Laplace*

[3 marks]
[*3 markah*]

ii. $F(s) = \dfrac{s + 4}{(s - 1)(s + 5)}$; Partial Fraction Method
; *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	$\bar{x} = \frac{\sum x}{n}$	$\bar{x} = \frac{\sum (fx)}{\sum f}$
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.	$\frac{d}{dx}(ax^n) = anx^{n-1} \quad [Power\ Rule]$
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.	$\frac{d}{dx}(\ln \lvert x \rvert) = \frac{1}{x}$	10.	$\frac{d}{dx}[\ln \lvert ax+b \rvert] = \frac{1}{ax+b} \times \frac{d}{dx}(ax+b)$
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.	$\int \frac{1}{x}\ dx = \ln\ \lvert x \rvert + c$	6.	$\int \frac{1}{ax+b}\ dx = \frac{1}{a} \times \ln\ \lvert ax+b \rvert + c$
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.	$\int sec^2(ax+b)\ dx = \frac{1}{a} \times \tan(ax+b) + c$		