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)

SULIT

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 by a group of students in a quiz. Solve the following questions by using formula and give the answer correct to TWO decimal places.

Jadual 1(a) di bawah menunjukkan markah kuiz yang diperolehi oleh sekumpulan pelajar. Selesaikan yang berikut menggunakan formula dan nyatakan jawapan betul sehingga DUA tempat perpuluhan

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

Marks	No of Students
5-9	4
10-14	9
15-19	16
20-24	12
25-29	6
30-34	3

i. Calculate mean

Kira min

[5 marks]

[*5 markah*]

ii. Calculate median

Kira median

[5 marks]

[*5 markah*]

CLO1 (b) Given the mean of the data $(x-2)$, $(x+5)$, $(x+3)$, $(3x-4)$, $(2x+7)$ is 7.
Diberi min bagi data (x-2), (x+5), (x+3), (3x-4), (2x+7) ialah 7

i. Determine the value of x
Tentukan nilai x

[4 marks]
[*4 markah*]

ii. Then, identify the median and the mode of the data
Kemudian, kenalpasti median dan mod bagi data tersebut

[4 marks]
[*4 markah*]

CLO1 (c) i. A box contains of 20 red marbles, 32 blue marbles, 17 yellow marbles and 11 white marbles. A marble is picked randomly from the box. Calculate the probability of picking a red marble.
Sebuah kotak mengandungi 20 guli merah, 32 guli biru, 17 guli kuning dan 11 guli putih. Sebiji guli dipilih secara rawak. Kira kebarangkalian untuk memilih sebiji guli merah.

[2 marks]
[*2 markah*]

ii. Ten pieces of paper numbered from 21 to 30 are placed in a file. A piece of paper is picked at random from the file. Calculate the probability of picking a number that is even OR divisible by 3.
Sepuluh keping kertas bernombor 21 hingga 30 diletakkan di dalam sebuah fail. Sekeping kertas dipilih secara rawak dari dalam fail. Kira kebarangkalian untuk memperolehi nombor genap ATAU nombor yang boleh dibahagi dengan 3.

[5 marks]
[*5 markah*]

QUESTION 2

SOALAN 2

CLO1 (a) Based on the following linear equations:

Berdasarkan persamaan linear di bawah;

$$2x - 2y + 4z = 10$$
$$x + 5y - 4z = 25$$
$$3x - y - 2z = 15$$

i. Construct Matrix L and Matrix U using Crout Method

Bina Matriks L dan Matriks U menggunakan Kaedah Crout

[10 marks]

[*10 markah*]

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

Kemudian, kira nilai x, y dan z

[8 marks]

[*8 markah*]

CLO1 (b) Use the Fixed-Point Iteration Method to determine the root for equation $f(x) = x^3 - 5x + 1$ when $x_0 = 2$. Give your answer correct to 2 decimal places.

Gunakan Kaedah Lelaran Titik Tetap untuk menentukan punca bagi persamaan $f(x) = x^3 - 5x + 1$ bila $x_0 = 1$. *Berikan jawapan anda tepat kepada 2 tempat perpuluhan.*

[7 marks]

[*7 markah*]

QUESTION 3

SOALAN 3

CLO1 (a) Categorize the following differential equations based on order and degree

Kategorikan persamaan pembezaan berikut berdasarkan peringkat dan darjah

i. $(\frac{d^2y}{dx^2})^3 + y(\frac{dy}{dx})^2 + y^5 = 0$

[2 marks]

[*2 markah*]

ii. $(\frac{d^3y}{dx^3})^2 + 3(\frac{dy}{dx})^3 - e^x - 4 = 0$

[2 marks]

[*2 markah*]

CLO1 (b) Use the stated method to solve the following first order differential equations:

Gunakan kaedah yang dinyatakan untuk menyelesaikan persamaan pembezaan peringkat pertama berikut:

i. $\frac{dy}{dx}e^{-x} + e^{2x} = 0$; Direct Integration Method

[5 marks]

[*5 markah*]

ii. $\frac{dy}{dx} + 5y = e^{-2x}$; Integrating Factor Method

[6 marks]

[*6 markah*]

CLO1 (c) Solve the following second order differential equations:

Selesaikan persamaan pembezaan peringkat kedua berikut:

i. $\frac{d^2y}{dx^2} + 8\frac{dy}{dx} + 15y = 0$

[4 marks]

[*4 markah*]

ii. $\frac{d^2y}{dx^2} - 3\frac{dy}{dx} + 10y = 0$

[6 marks]

[*6 markah*]

QUESTION 4

SOALAN 4

CLO1 (a) Produce the Laplace Transform for $f(t) = -4\,e^{-2t}$ by using the definition of Laplace Transform, $F(s) = \int_0^\infty e^{-st} f(t)dt$

Hasilkan Jelmaan Laplace bagi $f(t) = -4\,e^{-2t}$ *dengan menggunakan definisi Jelmaan Laplace,* $F(s) = \int_0^\infty e^{-st} f(t)dt$

[5 marks]

[*5 markah*]

CLO1 (b) Find the Laplace Transforms for:

Cari Jelmaan Laplace bagi:

i. $f(t) = 4t\sin 3t + t\cos 4t - 5\,t^2e^{4t}$ by using the Table of Laplace Transforms

$f(t) = 4t\sin 3t + t\cos 4t - 5\,t^2e^{4t}$ *dengan menggunakan Jadual Jelmaan Laplace*

[6 marks]

[*6 markah*]

ii. $g(t) = e^{-3t}\cos 2t$ by using the First Shift Theorem

$g(t) = e^{-3t}\cos 2t$ *dengan menggunakan Teorem Anjakan Pertama*

[4 marks]

[*4 markah*]

CLO1

(c) Solve each of the following using the specified method:

Selesaikan setiap yang berikut menggunakan kaedah yang dinyatakan:

i. $\mathcal{L}^{-1}\left\{\frac{24}{(s+2)^2-9}+\frac{12}{s^3}\right\}$; use the Table of Laplace Transforms

$\mathcal{L}^{-1}\left\{\frac{24}{(s+2)^2-9}+\frac{12}{s^3}\right\}$; *gunakan Jadual Jelmaan Laplace*

[4 marks]

[*4 markah*]

ii. $\mathcal{L}^{-1}\left\{\frac{s}{(s-3)(s+2)}\right\}$; use the Partial Fraction method

$\mathcal{L}^{-1}\left\{\frac{s}{(s-3)(s+2)}\right\}$; *gunakan kaedah Pecahan Separa*

[6 marks]

[*6 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	$s = \sqrt{\text{variance}}$	

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

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

SOLUTION FOR 1st ORDER DIFFERENTIAL EQUATION	
Homogeneous Equation $y=vx$ and $\frac{dy}{dx}=v+x\frac{dv}{dx}$	**Linear Factors (Integrating Factors)** $y\bullet IF=\int Q\bullet IF\,dx$ Where $IF=e^{\int P\,dx}$
	Logarithmic $a=e^{\ln a}$ $a^x=e^{x\ln a}$ $\int a^x\,dx=\frac{a^x}{\ln a}+c$
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 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.	$\int sec^2(ax+b)\ dx = \frac{1}{\frac{d}{dx}(ax+b)} \times \tan(ax+b) + c$		