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

DBM30033: ENGINEERING MATHEMATICS 3

TARIKH : 08 JUN 2023
MASA : 11.15 PG – 01.15 PTG (2 JAM)

Kertas ini mengandungi **LAPAN (8)** 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 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 has been selected from the 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. $\mathrm{xy}\frac{\mathrm{dy}}{\mathrm{dx}} = \frac{\mathrm{x}^2+7}{\mathrm{y}-3}$ (separating variable)

[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) A small construction firm specializes in building and selling family homes. The firm offers two types of houses model A and model B. Model A houses require 400 labour hours, 2 tons of stone, and 200 board feet of lumber. Model B houses require 1000 labour hours, 3 tons of stone, and 200 board feet of lumber. Due to a long times for ordering supplies and the scarcity of skilled and semiskilled workers in the area, the firm will be force to rely on its present resources. It has 40000 hours of labour, 15 tons of stone and 20000 board feet of lumber. The firm will get RM70000 and RM50000 profit for each Model A and Model B houses. Express the inequality in terms of x and y that satisfy the above conditions. State the objective function for a firm to get the maximum profit.

Sebuah firma pembinaan pakar dalam membina dan menjual rumah keluarga. Firma itu menawarkan dua jenis rumah model A dan model B. Rumah Model A memerlukan 400 jam tenaga buruh, 2 tan batu dan 200 kaki papan kayu. Rumah Model B memerlukan 1000 jam tenaga buruh, 3 tan batu, dan 200 kaki papan kayu. Disebabkan masa yang lama untuk menempah bekalan dan kekurangan pekerja mahir dan separuh mahir di kawasan itu, firma itu terpaksa bergantung pada sumber yang sedia ada. Firma mempunyai 40000 jam tenaga buruh, 15 tan batu dan 20000 kaki papan kayu. Firma itu akan mendapat keuntungan RM70000 dan RM50000 bagi setiap rumah Model A dan Model B. Nyatakan ketaksamaan dalam sebutan x dan y yang memenuhi syarat di atas. Nyatakan fungsi objektif bagi firma untuk mendapatkan keuntungan maksimum.

[5 marks]

[*5 markah*]

CLO1

(b) A factory makes tennis rackets and cricket bats. A tennis racket takes 1.5 hours of machine time and 3 hours of craftman time in its making while a cricket bat takes 3 hour of machine time and 1 hour of craftman time. In a day, the factory has the availability of not more than 42 hours of machine time and 24 hours of craftsman time.

Sebuah kilang membuat raket tenis dan pemukul kriket. Raket tenis mengambil masa 1.5 jam masa mesin dan 3 jam masa tukang dalam pembuatannya manakala kayu kriket mengambil masa 3 jam masa mesin dan 1 jam masa tukang. Dalam sehari, kilang mempunyai tidak lebih daripada 42 jam masa mesin dan 24 jam masa tukang.

i. Write **TWO (2)** inequalities to represent the information given.
*Tulis **DUA (2)** ketaksamaan yang mewakili maklumat yang telah diberikan.*

[2 marks]
[*2 markah*]

ii. Using a scale of 2cm to 5 units on both axis, calculate the maximum profit of the factory when it works at full capacity if the profit on a racket and on a bat is RM20 and RM10 respectively.
Menggunakan skala 2cm kepada 5 unit pada kedua-dua paksi, kira keuntungan maksimum kilang apabila beroperasi pada kapasiti penuh jika keuntungan untuk raket dan pemukul ialah masing-masing RM20 dan RM10.

[8 marks]
[*8 markah*]

CLO1

(c) Given linear programming problem with maximum value of objective function $P = 6x - 9y$ with constraint:

Diberi permasalahan pengaturcaraan linear dengan nilai maksimum bagi fungsi objektif $P = 6x - 9y$ *dengan kekangan:*

$$2x - 3y \leq 6$$
$$x + y \leq 20$$
$$x, y \geq 0$$

i. Write the problem in Standard Simplex Form.

Tuliskan pernyataan masalah dalam Bentuk Simplex Piawai.

[3 marks]

[*3 markah*]

ii. From the answer in c(i), convert the Standard Form equations into Initial Simplex Tableu.

Daripada jawapan c(i), tukarkan persamaan Bentuk Piawai tersebut kepada Jadual Simplex Permulaan.

[3 marks]

[*3 markah*]

iii. Solve the Initial Simplex Tableu to get the optimal solution.

Selesaikan Jadual Simplex Permulaan tersebut untuk mendapatkan penyelesaian optimum.

[4 marks]

[*4 markah*]

SOALAN TAMAT

FORMULA DBM30033 - 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 = $L_{Mo} + \left[\frac{d_1}{d_1 + d_2}\right] C$	
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	$x_{n+1}=x_n-\dfrac{f(x)}{f'(x)}$
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	$y=e^{\alpha x}(A\cos\beta x+B\sin\beta x)$

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