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

DBM30033: ENGINEERING MATHEMATICS 3

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

Kertas ini mengandungi **LAPAN (8)** halaman bercetak.

Struktur (4 soalan)

Dokumen sokongan yang disertakan : Kertas Graf dan 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 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) Express the **variables, objective function** and **constraints** that meet the description as below:

A company produced two special diet supplements for athletes, X and Y. The profit contributed by supplement X is RM40/unit and supplement Y is RM70/unit. Each ounce of supplement X contains 20 units of calcium, 15 units of iron and 10 units of vitamin B. Each ounce of supplement Y contains 10 units of calcium, 10 units of iron and 20 units of vitamin B. The minimum daily requirements for the diet are 300 units of calcium and 150 units of iron and 200 units of vitamin B.

*Ungkapkan **pembolehubah, fungsi objektif** dan **kekangan** yang memenuhi huraian seperti di bawah:*

Sebuah syarikat menghasilkan dua jenis makanan tambahan diet khas untuk ahli sukan, X dan Y. Keuntungan yang disumbangkan bagi makanan tambahan X adalah RM40/unit dan makanan tambahan Y adalah RM70/unit. Setiap auns makanan tambahan X mengandungi 20 unit kalsium, 15 unit zat besi dan 10 unit vitamin B. Setiap auns makanan tambahan Y pula mengandungi 10 unit kalsium, 10 unit zat besi dan 20 unit vitamin B. Jumlah minima pengambilan setiap hari untuk kalsium adalah 300 unit, untuk zat besi adalah 150 unit dan pengambilan vitamin B adalah 200 unit.

[5 marks]

[*5 markah*]

CLO1

(b) The maximum value of the objective function $Z = 8x_1 + 12x_2$ where $x_1 \geq 0$ and $x_2 \geq 0$ subject to the constraints:

Nilai maksimum fungsi objektif $Z = 8x_1 + 12x_2$ *di mana* $x_1 \geq 0$ *dan* $x_2 \geq 0$ *tertakluk kepada kekangan:*

$$x_1 + x_2 \leq 15$$
$$2x_1 + x_2 \geq 20$$
$$x_1 + 4x_2 \geq 16$$

i. Draw and shade the feasible region which fulfils the given condition by using the scale of 2cm to 2 unit for both $x_1 - axis$ and $x_2 - axis$.
Lukis dan lorek kawasan yang boleh dilaksanakan yang memenuhi syarat yang diberikan dengan menggunakan skala 2cm untuk 2 unit bagi kedua-dua paksi-x_1 *dan paksi-*x_2.

[7 marks]
[*7 markah*]

ii. Based on the graph at b(i), calculate the value of x_1 and x_2 to obtain the objective function for the above case.
Berdasarkan graf pada b(i), kirakan nilai x_1 and x_2 *untuk mencapai fungsi objektif bagi kes di atas.*

[3 marks]
[*3 markah*]

CLO1

(c) Given Linear Programming problem with, Maximum $P = 7x + 5y$ with constraint:

Diberi permasalahan Pengaturcaraan Linear dengan, Maksimum $P = 7x + 5y$ *dengan kekangan:*

$$4x + 3y \leq 12$$
$$x + 2y \leq 6$$
$$x, y \geq 0$$

i. Write the problem in Standard Simplex Form.
Tuliskan pernyataan masalah dalam Bentuk Simplex Piawai.

[2 marks]
[*2 markah*]

ii. From the answer for c(i), change the Standard Form equations into First Initial Tableau.
Daripada jawapan c(i), tukarkan persamaan Bentuk Piawai tersebut kepada Jadual Permulaan Tableau.

[3 marks]
[*3 markah*]

iii. Then, solve the First Initial Tableau to get the optimal solution.
Kemudian, selesaikan Jadual Permulaan Tableau tersebut untuk mendapatkan penyelesaian optimum.

[5 marks]
[*5 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	$Mode = L_{M_o} + \left(\frac{d_1}{d_1 + d_2}\right) C$	
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	$s = \sqrt{variance}$	

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

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	$x_0 = \dfrac{1}{y_2 - y_1} \begin{vmatrix} x_1 & y_1 \\ x_2 & y_2 \end{vmatrix}$	

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)** $\dfrac{dy}{dx} + Py = Q$ $y \cdot IF = \int Q \cdot IF \, dx$ 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	$y = e^{\alpha x}(A\cos\beta x + B\sin\beta x)$

DIFFERENTIATION			
1.	$\frac{d}{dx}(k) = 0\,,\quad k \text{ is constant}$	2.	$\frac{d}{dx}(ax^n) = anx^{n-1}$ [Power Rule]
3.	$\frac{d}{dx}\big(f(x) \pm g(x)\big) = f'(x) \pm g'(x)$	4.	$\frac{d}{dx}(uv) = u\frac{dv}{dx} + v\frac{du}{dx}$ [Product Rule]
5.	$\frac{d}{dx}\left(\frac{u}{v}\right) = \frac{v\frac{du}{dx} - u\frac{dv}{dx}}{v^2}$ [Quotient Rule]	6.	$\frac{dy}{dx} = \frac{du}{dx} \times \frac{dy}{du}$ [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.	$\int k\ dx = kx + c,\quad k \text{ is constant}$	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.	$\int \sin(ax+b)\ dx = -\frac{1}{a} \times \cos(ax+b) + c$		
13.	$\int \cos(ax+b)\ dx = \frac{1}{a} \times sin\,(ax+b) + c$		
14.	$\int sec^2(ax+b)\ dx = \frac{1}{a} \times \tan(ax+b) + c$		