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 I : 2024/2025

DBM30033: ENGINEERING MATHEMATICS 3

TARIKH : 26 NOVEMBER 2024
MASA : 8.30 PAGI – 10.30 PAGI (2 JAM)

Kertas ini mengandungi **SEMBILAN (9)** 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)

INSTRUCTION:

This section consists of **FOUR (4)** structured questions. Answer **ALL** the questions.

ARAHAN :

*Bahagian ini mengandungi **EMPAT (4)** soalan berstruktur. Jawab **SEMUA** soalan.*

QUESTION 1

SOALAN 1

CLO1 (a) The blood pressures of 100 patients in a hospital were measured and the information grouped as shown the following table (see Table 1(a)).

Tekanan darah bagi 100 orang pesakit di sebuah hospital diukur dan maklumat dikumpulkan seperti yang ditunjukkan dalam jadual berikut (lihat Jadual 1(a)).

Blood pressure *Tekanan darah*	**Frequency** *Kekerapan*
110 – 119	22
120 – 129	27
130 – 139	25
140 – 149	14
150 – 159	7
160 – 169	5

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

Calculate:

Kira:

i. mean

min

[4 marks]

[*4 markah*]

ii. median

median

[6 marks]

[*6 markah*]

CLO1 (b) Based on the given data, calculate:
Berdasarkan data yang diberi, kira:

6, 10, 11, 15, 24, 3, 10, 24, 13, 4

i. mode
mod

[2 marks]
[*2 markah*]

ii. variance
varians

[6 marks]
[6 *markah*]

CLO1 (c) A fair dice is rolled. Calculate the probability of getting:
Satu dadu yang adil dilambung. Kira kebarangkalian untuk dapatkan:

i. $P(prime\ number \cap odd\ number)$
$P(nombor\ perdana \cap nombor\ ganjil)$

[3 marks]
[*3 markah*]

ii. $P(prime\ number \cup odd\ number)$
$P(nombor\ perdana \cup nombor\ ganjil)$

[4 marks]
[*4 markah*]

QUESTION 2

SOALAN 2

CLO1 (a) Based on the following linear equations:

Berdasarkan persamaan linear yang berikut:

$$-2p + 4q = -3 - 3r$$
$$3p + 2q - 4r = 19$$
$$4p + 3q + 5r = -5$$

i. Determine matrix L and U by using Doolittle method.

Tentukan matriks L dan U dengan menggunakan kaedah Doolittle.

[10 marks]

[*10 markah*]

ii. Then, calculate the value of p, q and r.

Kemudian, kira nilai p, q *dan* r.

[8 marks]

[*8 markah*]

CLO1 (b) Determine the root for $f(x) = x^3 + x - 3$ by using Newton Raphson method with $x_0 = 1.5$. Give your answer correct to three decimal places.

Tentukan punca $f(x) = x^3 + x - 3$ *dengan menggunakan kaedah Newton Raphson dengan* $x_0 = 1.5$. *Berikan jawapan anda betul kepada tiga tempat perpuluhan.*

[7 marks]

[*7 markah*]

QUESTION 3

SOALAN 3

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

Kenal pasti peringkat dan darjah bagi persamaan pembezaan yang berikut.

i. $\frac{d^2y}{dx^2} + \left(\frac{dy}{dx}\right)^2 = k^2 + \left(\frac{d^3y}{dx^3}\right)^3$

[2 marks]

[*2 markah*]

ii. $\frac{d^2y}{dx^2} + \left(\frac{dy}{dx}\right)^5 + \sin x = 3$

[2 marks]

[*2 markah*]

CLO1 (b) Solve the following first order differential equations by using stated method.

Selesaikan persamaan pembezaan peringkat pertama berikut dengan menggunakan kaedah yang dinyatakan.

i. $\frac{dy}{dx} = x^3 + 5$; Direct Integration

; *Pengamiran terus*

[5 marks]

[*markah*]

ii. $y^2 \frac{dy}{dx} = \frac{e^{3x+3x}}{y}$; Separating the Variables

; *Pemisah pemboleh ubah*

[6 marks]

[*6 markah*]

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

Selesaikan persamaan pembezaan peringkat kedua berikut.

i. $\frac{d^2y}{dx^2} + 12y = 7\frac{dy}{dx}$

[5 marks]

[*5 markah*]

ii. $\frac{d^2y}{dx^2} + 4\frac{dy}{dx} + 9y = 0$

[5 marks]

[*5 markah*]

QUESTION 4

SOALAN 4

CLO1 (a) A bakery produces two types of pastries: croissants and muffins. The bakery wants to maximize its weekly profit. Each croissant earns RM2 and each muffin earns RM3. Producing a croissant requires 1 hour of baking time and 2 units of flour, while a muffin requires 1.5 hours of baking time and 1 unit of flour. The bakery has a total of 40 baking hours and 30 units of flour available each week. Identify the variables, objective function and constraints that meet the description above.

Sebuah kedai roti menghasilkan dua jenis pastri: croissant dan mufin. Kedai roti tersebut ingin memaksimumkan keuntungan mingguan mereka. Setiap croissant memberikan keuntungan sebanyak RM2 dan setiap mufin memberikan keuntungan sebanyak RM3. Untuk menghasilkan satu croissant memerlukan 1 jam masa pembakaran dan 2 unit tepung, manakala satu mufin memerlukan 1.5 jam masa pembakaran dan 1 unit tepung. Kedai roti tersebut mempunyai jumlah maksimum 40 jam masa pembakaran dan 30 unit tepung yang tersedia setiap minggu. Kenal pasti pembolehubah-pembolehubah, fungsi objektif dan kekangan-kekangan yang memenuhi huraian di atas.

[5 marks]

[*5 markah*]

CLO1 (b) A certain motorcycle manufacturer produces two basic models, the Super X and the Super Y. These motorcycles are sold to dealers at a profit of RM20000 per Super X and RM10000 per Super Y. A Super X requires 150 hours for assembly, 50 hours for painting and finishing and 10 hours for checking and testing. The Super Y requires 60 hours for assembly, 40 hours for painting and finishing and 20 hours for checking and testing. The total number of hours available per month is: 30000 in the assembly department, 13000 in the painting and finishing department and 5000 in the checking and testing department. Let x be the number of Super X and y be the number of Super Y models manufactured per month.

Pengilang motosikal tertentu menghasilkan dua model asas, Super X dan Super Y. Motosikal ini dijual kepada peniaga dengan keuntungan RM20000 setiap Super X dan RM10000 setiap Super Y. Super X memerlukan 150 jam untuk pemasangan, 50 jam untuk mengecat dan perapian dan 10 jam untuk pemeriksaan dan pengujian. Super Y memerlukan 60 jam untuk pemasangan, 40 jam untuk mengecat dan perapian dan 20 jam untuk pemeriksaan dan pengujian. Jumlah jam yang tersedia setiap bulan adalah: 30000 di bahagian pemasangan, 13000 di bahagian mengecat dan perapian dan 5000 di bahagian pemeriksaan dan pengujian. Andaikan x menjadi bilangan Super X dan y adalah bilangan model Super Y yang dihasilkan setiap bulan.

i. Write **THREE (3)** inequalities other than $x \geq 0$ and $y \geq 0$ that satisfy all of the above constraints.

*Nyatakan **TIGA (3)** ketaksamaan selain $x \geq 0$ dan $y \geq 0$ yang memenuhi kekangan di atas.*

[3 marks]

[*3 markah*]

ii. Draw and shade the feasible region that satisfied all the given constraints.

Lukis dan lorekkan rantau yang memenuhi semua kekangan yang diberi.

[7 marks]

[*7 markah*]

CLO1 (c) Given Linear Programming problem with maximum $Z = 20x + 10y$ with constraints:

Diberi permasalahan Pengaturcaraan Linear dengan maksimum $Z = 20x + 10y$ *dengan kekangan:*

$$x + 2y \leq 10$$
$$x + y \leq 8$$
$$x + 3y \leq 15$$
$$x \geq 0\,,\; y \geq 0$$

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

[2 marks]
[*2 markah*]

ii. From the answer (c)i., change the standard form equations into Initial Simplex Tableau.
Daripada jawapan (c)i., tukarkan persamaan bentuk piawai kepada Jadual Simpleks Permulaan.

[3 marks]
[*3 markah*]

iii. Then, solve the Initial Simplex Tableau to get the optimal solution.
Kemudian, selesaikan Jadual Simpleks Permulaan 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.	$\frac{d}{dx}(ax^n) = anx^{n-1}\quad [Power\ Rule]$
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.	$\frac{d}{dx}(\ln\|x\|) = \frac{1}{x}$	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.	$\int sec^2(ax+b)\ dx = \frac{1}{a} \times \tan(ax+b) + c$		