SULIT

BAHAGIAN PEPERIKSAAN DAN PENILAIAN
JABATAN PENDIDIKAN POLITEKNIK DAN KOLEJ KOMUNITI
KEMENTERIAN PENGAJIAN TINGGI

JABATAN MATEMATIK, SAINS & KOMPUTER

PEPERIKSAAN AKHIR

SESI II : 2021/2022

DBM30033: ENGINEERING MATHEMATICS 3

TARIKH : 29 JUN 2022
MASA : 08.30 PAGI – 10.30 PAGI (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 berstruktur. Jawab **SEMUA** soalan.*

QUESTION 1

SOALAN 1

CLO1
C3

(a) Table 1(a) shows the Typing Speed of Secretarial Students. By referring the table 1(a), answer all the questions below and give the answers correct to 2 decimal places.

Jadual 1(a) menunjukkan Kelajuan Menaip Pelajar Kesetiausahaan. Daripada jadual 1(a), jawab semua soalan di bawah dan berikan jawapan yang betul hingga 2 titik perpuluhan.

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

Time (minute) *Masa (minit)*	Number of students *Bilangan Pelajar*
1-10	13
11 -20	11
21-30	20
31-40	10
41-50	6

i. Find Mode.
Cari Mod.

[4 marks]
[*4 markah*]

ii. Find Median.
Cari Median.

[5 marks]
[*5 markah*]

iii. Find Mean.
Cari min.

[6 marks]
[*6 markah*]

CLO1
C3

(b) Table 2(b) shows the number of students in three groups. A student is chosen randomly from each group. Determine the probability of choosing:
Jadual 2(b) menunjukkan bilangan pelajar dalam tiga kumpulan. Seorang pelajar dipilih secara rawak dari setiap kumpulan. Tentukan kebarangkalian memilih:

Table 2(b) / *Jadual 2(b)*

Group *Kumpulan*	Number of boys *Bilangan lelaki*	Number of girls *Bilangan perempuan*
A	3	5
B	4	6
C	5	4

i. all of them are boys.
kesemua pelajar tersebut adalah lelaki.

[3 marks]
[*3 markah*]

ii. a boy and two girls.
seorang pelajar lelaki dan dua orang pelajar perempuan.

[7 marks]
[*7 markah*]

QUESTION 2

SOALAN 2

CLO1
C3

(a) i. Convert the following system of linear equations into $AX = B$ form:
Tukarkan sistem persamaan linear berikut kepada bentuk $AX = B$:

a. $9y - 6z = 5$
$7x + 9y - 2z = 6$
$z + 8y = -3$

[2 marks]
[*2 markah*]

b. $3p + 6q - 2r = 0$
$8p + 9q + 4 = 5r$
$q + 3r = 3$

[2 marks]
[*2 markah*]

ii. Solve the following system of linear equations by using Gaussian Elimination Method.
Selesaikan sistem persamaan linear berikut menggunakan Kaedah Penghapusan Gauss.

$$2x + y - 2z = 2$$
$$x + 2y = 3 - 2z$$
$$3y + z = -1$$

[11 marks]
[*11 markah*]

(b) Given the equation $x^4 - 2x^3 - x + 1 = 0$. Find the root of the equation by using Newton Raphson Method where the root is between $x = 0$ and $x = 1$. Give the answer correct to three decimal places.

Diberi persamaan $x^4 - 2x^3 - x + 1 = 0$. *Dapatkan punca bagi persamaan dengan menggunakan Kaedah Newton Raphson di mana puncanya di antara* $x = 0$ dan $x = 1$. *Berikan jawapan yang betul hingga tiga titik perpuluhan.*

[10 marks]

[*10 markah*]

QUESTION 3

SOALAN 3

(a) Solve the following differential equations:

Selesaikan persamaan pembezaan berikut:

i. $\frac{dy}{dx} + \frac{y}{x} = x^4$

[5 marks]

[*5 markah*]

ii. $\frac{dy}{dx} - \frac{y}{3x - 1} = 0$

[5 marks]

[*5 markah*]

(b) Determine the general solution for the following differential equations:

Tentukan penyelesaian am bagi persamaan pembezaan berikut:

i. $\frac{d^2y}{dx^2} = 16y$

[5 marks]

[*5 markah*]

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

[5 marks]

[5 *markah*]

iii. $3y'' + 4y + 2 = 0$

[5 marks]

[5 *markah*]

QUESTION 4

SOALAN 4

CLO1
C3

(a) The Parker's Electric Train Service (PETS) Company offers economy and first class tickets. For the PETS Company to be profitable, it must sell a minimum of 100 first class tickets and a minimum of 200 economy class tickets. At most, the PETS has a capacity of 500 passengers. The PETS Company makes a profit of RM50.00 for each economy ticket and RM80.00 for each first class ticket. Identify the variables for the case above and find out all the inequalities other than $x \geq 0$ and $y \geq 0$.

Syarikat Perkhidmatan Kereta Api Elektrik Parker (PETS) menawarkan tiket ekonomi dan kelas pertama. Bagi Syarikat PETS untuk mendapat keuntungan, ia mesti menjual sekurang-kurangnya 100 tiket kelas pertama dan sekurang-kurangnya 200 tiket kelas ekonomi. Paling banyak, PETS mempunyai kapasiti sebanyak 500 penumpang. Syarikat PETS memperoleh keuntungan sebanyak RM50.00 untuk setiap tiket ekonomi dan RM80.00 untuk setiap tiket kelas pertama. Kenalpasti pembolehubah - pembolehubah bagi kes di atas dan dapatkan semua ketaksamaan yang memenuhi syarat selain $x \geq 0 \; dan \; y \geq 0$.

[5 marks]

[*5 markah*]

CLO1
C3

(b) The maximum value of the objective function $Z = 6x + 4y$ where $x \geq 0$ and $y \geq 0$ subject to the constraints.

Nilai maksimum fungsi objektif $Z = 6x + 4y$ *di mana* $x \geq 0$ *dan* $y \geq 0$ *tertakluk kepada kekangan.*

$$30x \leq 720 - 50y$$
$$40x + 20y \geq 200$$
$$4x \geq 3y$$

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

[7 marks]
[*7 markah*]

ii. Based on the graph at b(i), calculate the maximum profit gained by the company.
Berdasarkan graf pada b(i), kirakan keuntungan maksimum yang diperoleh syarikat tersebut.

[3 marks]
[*3 markah*]

CLO1
C3

(c) Solve the following linear programming by using Simplex Method to define the maximum value of objective function $Z = 11x_1 + 16x_2 + 15x_3$ where $x_1, x_2, x_3 \geq 0$ subject to the constraints

Selesaikan pengaturcaraan linear berikut dengan menggunakan Kaedah Simplek untuk menentukan nilai maksimum bagi fungsi objektif $Z = 11x_1 + 16x_2 + 15x_3$ *di mana* $x_1, x_2, x_3 \geq 0$ *tertakluk kepada kekangan*

$$1x_1 + 2x_2 + \frac{3}{2}x_3 \leq 12000$$

$$\frac{2}{3}x_1 + \frac{2}{3}x_2 + 1x_3 \leq 4600$$

$$\frac{1}{2}x_1 + \frac{1}{3}x_2 + \frac{1}{2}x_3 \leq 2400$$

[10 marks]

[*10 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	$E = \frac{\sum \lvert x - \bar{x} \rvert}{n}$	$E = \frac{\sum \left(\lvert x - \bar{x} \rvert f \right)}{\sum f}$
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	$A=\begin{pmatrix} l_{11} & 0 & 0 \\ l_{21} & l_{22} & 0 \\ l_{31} & l_{32} & l_{33} \end{pmatrix}\begin{pmatrix} 1 & u_{12} & u_{13} \\ 0 & 1 & u_{23} \\ 0 & 0 & 1 \end{pmatrix}$
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	$y = e^{\alpha x}(A\cos\beta x + B\sin\beta x)$

DIFFERENTIATION			
1.	$\frac{d}{dx}(k) = 0\,, \qquad k\ is\ constant$	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.	$\int k\ dx = kx + c, \qquad k\ is\ constant$	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.	$\int sec^2(ax+b)\ dx = \frac{1}{a} \times \ \tan(ax+b) + c$		