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 : 2026/2027

DBM30183: MATHEMATICS ENGINEERING 3

TARIKH : 04 NOVEMBER 2026
MASA : 8.30 PAGI – 10.30 PAGI (2 JAM)

Kertas ini mengandungi **SEMBILAN (9)** halaman bercetak.

Struktur (4 soalan)

Dokumen sokongan yang disertakan : Formula dan Kertas Graf

JANGAN BUKA KERTAS SOALAN INI SEHINGGA DIARAHKAN

(CLO yang tertera hanya sebagai rujukan)

TERBUKA

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

CLO 1

(a) The following are the students' Quiz 1 scores for the Mathematics course at Sultan Mizan Zainal Abidin Polytechnic;

Berikut adalah taburan markah Kuiz 1 pelajar bagi kursus Matematik di Politeknik Sultan Mizan Zainal Abidin;

5 , 6 , 8 , 10 , 9 , 8 , 8 , 7 , 8 , 7 , 8 , 7 , 7 , 6 , 5 , 10 , 9 , 8 , 8 , 10

i. calculate the mode of the quiz 1 scores above.

kirakan mod bagi markah kuiz 1 di atas.

[1 mark]

[*1 markah*]

ii. calculate the mean of the Quiz 1 scores.

kirakan min bagi markah Kuiz 1 tersebut.

[4 marks]

[*4 markah*]

iii. calculate the mean deviation of the quiz 1 scores.

kirakan sisihan min bagi markah kuiz 1.

[5 marks]

[*5 markah*]

TERBUKA

CLO 2 (b) In the Final Examination for the Mathematics Course at the Polytechnic, the scores obtained by 256 students are as follows;

Dalam Peperiksaan Akhir bagi Kursus Matematik di Politeknik, markah yang diperolehi oleh 256 orang pelajar adalah seperti berikut;

Table 1(b) / *Jadual 1(b)*

Marks (%) ***Markah (%)***	**No. of Students** ***Bilangan Pelajar***
1-10	10
11-20	20
21-30	30
31-40	40
41-50	50
51-60	40
61-70	30
71-80	20
81-90	10
91-100	6

Refering to the Table 1(b) above, calculate;

Merujuk kepada Jadual 1(b) di atas, kirakan;

i. mean

min

[5 marks]

[*5 markah*]

ii. mode

mod

TERBUKA

[5 marks]

[*5 markah*]

CLO 2 (c) A lecturer purchased a box of plastic balls to be used in a STEM programme. The box contains 10 red balls, 15 blue balls, 25 yellow balls and 30 green balls. Three balls are given to each participant **without replacement.**

Calculate the probability that a student receives a green ball first, a blue ball second and a yellow ball third.

Seorang pensyarah membeli sekotak bola plastik untuk digunakan dalam program STEM. Di dalam kotak tersebut mengandungi 10 biji bola merah, 15 biji bola biru, 25 biji bola kuning dan 30 biji bola hijau. Tiga biji bola telah diberikan kepada setiap peserta ***tanpa penggantian****. Kirakan kebarangkalian untuk pelajar memperolehi bola pertama hijau, bola kedua biru dan bola ketiga kuning.*

[5 marks]

[*5 markah*]

TERBUKA

QUESTION 2

SOALAN 2

CLO2 (a) Based on the following linear equations:

Berdasarkan persamaaan linear yang berikut:

$$e + 2f - 5g = -6$$
$$-3g + 4f + 7 = -4e$$
$$5e + 7f - 13g = -9$$

i. construct the matrix L and matrix U using Crout method.

bina matrik L dan matrik U menggunakan kaedah Crout.

[13 marks]

[*13 markah*]

ii. calculate the elements of e, f and g.

kirakan unsur e, f dan g .

[5 marks]

[*5 markah*]

CLO1 (b) Solve the root equation of $5x^4 + 4x^3 + 3x^2 - 2 = 0$ correct to 3 decimal places by using the Newton Raphson Method. Given $x_0 = 1$.

Selesaikan punca bagi persamaan $5x^4 + 4x^3 + 3x^2 - 2 = 0$ *betul kepada 3 tempat perpuluhan menggunakan Kaedah Newton Raphson. Diberi* $x_0 = 1$.

[7 marks]

[*7 markah*]

TERBUKA

QUESTION 3

SOALAN 3

CLO 2 (a) Solve the following differential equations using the stated method:

Selesaikan persamaan berikut dengan menggunakan kaedah yang dinyatakan:

i. $2x\,\frac{dy}{dx} = 4x - 6x\,sinx$; Direct Integration

; *Pengamiran Langsung*

[5 marks]

[*5 markah*]

ii. $x\,\frac{dy}{dx} = 2xy - y$; Separating Variables

; *Memisahkan Pembolehubah*

[5 marks]

[*5 markah*]

iii. $\frac{dy}{dx} + y = e^x$; Integrating Factors

; *Faktor Pengamiran*

[5 marks]

[*5 markah*]

CLO 1 (b) Solve the following second order differential equations below:

Selesaikan persamaan pembezaan peringkat kedua di bawah:

i. $y'' + 4y' = 5y$

[4 marks]

[*4 markah*]

ii. $y'' + 2y' + 7y = 0$

[6 marks]

[*6 markah*]

TERBUKA

QUESTION 4

SOALAN 4

CLO1

(a) A farmer grows corn (x) and wheat (y). The land and labour limitations are

Seorang petani menanam jagung (x) dan gandum (y). Had tanah dan buruh ialah

$$x + 3y \leq 90$$

$$2x + y \leq 80$$

$$x, y \geq 0$$

The profit function is

Fungsi keuntungan ialah

$$P = 60x + 40y$$

i. Illustrate the feasible region by using the scale of 2 cm to 10 units for both x-axis and y-axis.

Ilustrasi kawasan boleh dilaksanakan dengan menggunakan skala 2 cm kepada 10 unit untuk kedua-dua paksi-x dan paksi-y.

[4 marks]

[*4 markah*]

ii. Determine the optimal production plan and the maximum profit using the graphical method.

Tentukan pelan pengeluaran optimum dan keuntungan maksimum menggunakan kaedah grafik.

[6 marks]

[*6 markah*]

TERBUKA

CLO2

(b) A manufacturer produces two types of models, M1 and M2. M1 model requires 4 hours of grinding and 2 hours of polishing, whereas M2 model requires 2 hours of grinding and 5 hours of polishing. The manufacturer has one grinder and two polishers. Each grinder works for 40 hours a week and each polisher works 70 hours a week. Profit of M1 model is RM3.00 and M2 model is RM4.00. Whatever is produced in a week is sold in the market.

Seorang pengilang menghasilkan dua jenis model, M1 dan M2. Setiap model jenis M1 memerlukan 4 jam pengisaran dan 2 jam penggilapan, manakala setiap model M2 memerlukan 2 jam pengisaran dan 5 jam penggilapan. Pengilang mempunyai satu pengisar dan dua mesin penggilap. Setiap pengisar bekerja selama 40 jam seminggu dan setiap mesin penggilap bekerja 70 jam seminggu. Keuntungan pada model MI ialah RM3.00 dan pada model M2 ialah RM4.00. Apa sahaja yang dihasilkan dalam seminggu dijual di pasaran.

i. Write the objective function and two inequalities, other than $x \geq 0$ and $y \geq 0$, which satisfy all the above constraints.

Ungkapkan fungsi objektif dan dua ketaksamaan, selain $x \geq 0$ dan $y \geq 0$ yang memenuhi semua kekangan di atas.

[3 marks]

[*3 markah*]

ii. Change the objective function and inequalities above into Standard Form.

Tukarkan fungsi objektif dan ketaksamaan di atas ke dalam Bentuk Piawai.

TERBUKA

[3 marks]

[*3 markah*]

iii. Determine should the manufacturer allocate his production capacity of the two models to maximize profit in a week using the simplex method?
Tentukan bagaimanakah pengilang harus memperuntukkan kapasiti pengeluarannya kepada kedua-dua model tersebut untuk membuat keuntungan maksimum dalam seminggu menggunakan kaedah simpleks?

[9 marks]
[*9 markah*]

TERBUKA

SOALAN TAMAT

FORMULA DBM30183 - 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. 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.	$\frac{d}{dx}(\ln \lvert x \rvert) = \frac{1}{x}$	10.	$\frac{d}{dx}[\ln \lvert ax+b \rvert] = \frac{1}{ax+b} \times \frac{d}{dx}(ax+b)$
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.	$\int \frac{1}{x}\ dx = \ln\ \lvert x \rvert + c$	6.	$\int \frac{1}{ax+b}\ dx = \frac{1}{a} \times \ln\ \lvert ax+b \rvert + c$
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.	$\int sec^2(ax+b)\ dx = \frac{1}{a} \times \tan(ax+b) + c$		