SULIT

POLITEKNIK MALAYSIA

BAHAGIAN PEPERIKSAAN DAN PENILAIAN
JABATAN PENDIDIKAN POLITEKNIK DAN KOLEJ KOMUNITI
KEMENTERIAN PENDIDIKAN MALAYSIA

JABATAN MATEMATIK, SAINS & KOMPUTER

PEPERIKSAAN AKHIR

SESI JUN 2018

DBM3013: ENGINEERING MATHEMATICS 3

TARIKH : 09 NOVEMBER 2018
MASA : 8.30 PAGI - 10.30 PAGI (2 JAM)

Kertas ini mengandungi **DUA BELAS (12)** halaman bercetak.
Bahagian A: Struktur (4 soalan)
Bahagian B: Struktur (2 soalan)
Dokumen sokongan yang disertakan : Kertas Graf & Formula

JANGAN BUKA KERTAS SOALAN INI SEHINGGA DIARAHKAN

(CLO yang tertera hanya sebagai rujukan)

SECTION A: 75 MARKS

BAHAGIAN A: 75 MARKAH

INSTRUCTION:

This section consists of **FOUR (4)** structured questions. Answer only THREE (3) questions.

ARAHAN:

*Bahagian ini mengandungi **EMPAT (4)** soalan berstruktur. Jawab **TIGA (3)** soalan sahaja.*

QUESTION 1

SOALAN 1

CLO2
C2

(a) Given the mean of the data (x-5), (x+5), (x+8), (3x-4), (4x+7) is 12.2.

Diberi min bagi set data (x-5), (x+5), (x+8), (3x-4), (4x+7) ialah 12.2.

i. Find the value of x.

Cari nilai x.

[4 marks]

[*4 markah*]

ii. Then, find the variance and standard deviation of the data.

Kemudian, cari varian dan sisihan piawai bagi data tersebut.

[6 marks]

[*6 markah*]

CLO2
C3

(b)

12	10	22	23	25	41	41	20	90	25
65	13	89	47	33	52	47	65	66	32
55	13	88	37	81	53	50	64	71	90
45	90	19	57	73	53	11	30	72	44
34	87	17	67	80	11	14	15	70	40

i. Based on the data given above, draw a "less than" ogive graph, using 5-14 as a first class.
Berdasarkan data yang diberikan, lukis graf ogif "kurang daripada" dengan menggunakan 5-14 sebagai kelas pertama.

[9 marks]
[*9 markah*]

ii. Then, determine the first quartile and 7^{th} decile from the given data.
Kemudian, tentukan nilai kuartil pertama dan nilai desil ke 7 dari data yang diberikan.

[6 marks]
[*6 markah*]

QUESTION 2

SOALAN 2

CLO2
C2

(a)

8	4	5	6	4	3	9

The diagram shows a telephone number. One digit is picked at random from the telephone number. Find the probability that the digit picked is:

Diagram menunjukkan satu nombor telefon. Satu digit diambil secara rawak daripada nombor telefon tersebut. Tentukan kebarangkalian digit yang diambil adalah:

i. number 4
nombor 4

[2 marks]
[*2 markah*]

ii. an odd number
nombor ganjil

[2 marks]
[*2 markah*]

iii. a multiple of 3 OR less than 7
gandaan 3 ATAU kurang dari 7

[6 marks]
[*6 markah*]

CLO2
C3

(b) Dina and Hafiz are invited to attend a wedding ceremony. The probability that Dina will attend the ceremony is 3/10 and the probability Hafiz will attend the ceremony is 4/7. Assume that both Dina and Hafiz do not influence each other to attend the ceremony, find the probability that:

Dina dan Hafiz telah dijemput ke majlis perkahwinan. Kebarangkalian Dina akan menghadirkan diri ialah 3/10 manakala kebarangkalian Hafiz akan menghadiri majlis tersebut ialah 4/7. Dengan anggapan bahawa Dina dan Hafiz tidak mempengaruhi antara satu sama lain untuk menghadiri majlis tersebut, tentukan kebarangkalian:

i. Both Dina and Hafiz will attend the ceremony.
Kedua-dua Dina dan Hafiz akan menghadiri majlis tersebut.

[3 marks]
[*3 markah*]

ii. None of them will attend the ceremony.
Tiada di antara mereka akan menghadiri majlis tersebut.

[3 marks]
[*3 markah*]

iii. Only one of them will attend the ceremony.
Hanya salah seorang dari mereka yang menghadiri majlis tersebut.

[4 marks]
[*4 markah*]

iv. At least one of them will attend the ceremony.
Sekurang-kurangnya seorang dari mereka yang menghadiri majlis tersebut.

[5 marks]
[*5 markah*]

QUESTION 3

SOALAN 3

CLO2
C2

(a) Sketch and shade the feasible regions which satisfy the given condition.

Lakar dan lorekkan rantau tersaur yang memenuhi syarat yang diberikan.

i. $x \geq -2$

[2 marks]

[*2 markah*]

ii. $y \leq 6$

[2 marks]

[*2 markah*]

iii. $2y \geq 6x + 12$

[3 marks]

[3 *markah*]

iv. $6x - 6y \geq 12$

[3 marks]

[3 *markah*]

CLO2
C3

(b) Pn. Zura prepares two types of pasta that she wants to sell. She buys the ingredients from a wholesaler at the price of RM4 for macaroni carbonara and RM8 for lasagna cheese. The total pasta sold is at least 100 packs per day. The number of macaroni carbonara is not more than twice the number of lasagna cheese. The preparation of lasagna cheese cannot exceed three times from the number of macaroni carbonara. Pn. Zura has only RM760 to make that purchase. She sells one pack of macaroni carbonara and lasagna cheese at RM9 and RM16 respectively. Given, **x** is macaroni carbonara and **y** is lasagna cheese.

Pn. Zura menyediakan dua jenis pasta yang ingin dijual. Dia membeli bahan-bahan dari pemborong dengan harga RM4 untuk makaroni carbonara dan RM8 untuk lasagna keju. Jumlah pasta yang dijual setiap hari sekurang-kurangnya 100 pek. Bilangan makaroni karbonara tidak lebih daripada dua kali bilangan lasagna keju. Masa penyediaan lasagna keju tidak melebihi dari tiga kali jumlah makaroni karbonara. Pn. Zura hanya mempunyai RM760 untuk membuat pembelian itu. Dia menjual setiap makaroni karbonara dan lasagna keju pada harga RM9 dan RM16. Diberi x ialah makaroni karbonara dan y ialah lasagna keju.

i. List four inequalities, other than $x \geq 0$ and $y \geq 0$ that satisfy all the above condition.
Senaraikan empat ketaksamaan yang memenuhi syarat di atas selain daripada $x \geq 0$ *dan* $y \geq 0$.

[4 marks]
[4 *markah*]

ii. State the objective function for Pn. Zura to get the maximum profit.
Nyatakan fungsi objektif supaya Pn.Zura mendapat keuntungan yang maksimum.

[1 mark]
[*1 markah*]

iii. Using a scale of 2 cm to 40 on x-axis and 2 cm to 20 on the y-axis, draw and shade the feasible region which satisfies the given condition. Based on the graph, find the maximum profit to be gained by Pn. Zura.

Menggunakan skala 2 cm bersamaan 40 pada paksi x dan 2 cm bersamaan 20 pada paksi y, lukis dan lorekkan rantau tersaur yang memenuhi syarat-syarat yang diberikan. Berdasarkan graf, carikan keuntungan maksimum yang boleh diperolehi Pn. Zura.

[10 marks]

[*10 markah*]

QUESTION 4

SOALAN 4

CLO2
C2

(a) A company manufactures different types of sensor. Optical Sensor requires 2 hours to assemble and 1 hour to test, while Thermal Sensor requires 3 hours to assemble and 1 hour to test. Acoustics Sensor requires 2 hours to assemble and 2 hours to test. The company has labour to assemble up to 1000 hours and 800 hours test time, each week. If the profit on each sensor is RM7, RM8, RM10 respectively;

Sebuah syarikat mengeluarkan pelbagai jenis sensor. Sensor Optik memerlukan 2 jam untuk dipasang dan 1 jam untuk diuji, sementara Sensor Termal memerlukan 3 jam untuk dipasang dan 1 jam untuk diuji. Sensor Akustik memerlukan 2 jam untuk dipasang dan 2 jam untuk diuji. Syarikat itu mempunyai tenaga buruh untuk memasang sehingga 1000 jam dan 800 jam waktu ujian, setiap minggu. Sekiranya keuntungan pada setiap sensor adalah RM7, RM8, RM10 masing-masing;

i. State the information for the above statement in the simplest table.
Nyatakan maklumat untuk kenyataan di atas dalam bentuk jadual yang mudah difahami.

[8 marks]
[*8 markah*]

ii. State the constraints for the above statement.
Nyatakan kekangan-kekangan untuk penyataan masalah di atas.

[2 marks]
[*2 markah*]

CLO2
C3

(b) Solve the Linear Programming problem using Simplex Method.
Selesaikan masalah Pengaturcaraan Linear berikut dengan menggunakan Kaedah Simpleks.

Maximize, $P = 7x + 8y + 10z$ subject to constraints:
Maksimum, $P = 7x + 8y + 10z$ *tertakluk kepada kekangan :*

$$2x + 3y + 2z \leq 1000$$
$$x + y + 2z \leq 800$$
$$x \geq 0, y \geq 0, z \geq 0$$

[15 marks]
[*15 markah*]

SECTION B: 25 MARKS

BAHAGIAN B: 25 MARKAH

INSTRUCTION:

This section consists of **TWO** (2) structured questions. Answer only **ONE (1)** question.

ARAHAN:

Bahagian ini mengandungi DUA (2) soalan struktur. Jawab SATU (1) soalan sahaja.

QUESTION 5

SOALAN 5

CLO1 C2 (a) i. State **THREE (3)** methods to find the root of linear equation.

Nyatakan TIGA (3) kaedah untuk mencari punca persamaan linear.

[3 marks]

[*3 markah*]

ii. Find the real root of $x^5 - x - 7 = 0$ with the initial value $x_0 = 2$. Give the correct answer to 4 decimal places.

Tentukan punca persamaan $x^5 - x - 7 = 0$ *dengan nilai awal* $x_0 = 2$ *. Berikan jawapan tepat kepada 4 titik perpuluhan.*

[7 marks]

[*7 markah*]

CLO1 C3 (b) Solve the following linear equation using Gaussian Elimination Method.

Selesaikan persamaan linear berikut menggunakan Kaedah Penghapusan Gauss.

$$\begin{aligned} 3x \quad -2y \quad +z &= 0 \\ -4x \quad +3y \quad -z &= -2 \\ 3x \quad +4y \quad +5z &= 6 \end{aligned}$$

[15 marks]

[*15 markah*]

QUESTION 6

SOALAN 6

CLO1 C2 (a) i. State the order and the degree for the following differential equation:

Nyatakan peringkat dan kuasa bagi persamaan pembezaan berikut:

a. $$x\left(\frac{d^2y}{dx^2}\right)-\left(\frac{dy}{dx}\right)^4=4y$$

[2 marks]

[*2 markah*]

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

[2 marks]

[*2 markah*]

ii. Solve the second order of differential equations below:

Selesaikan persamaan pembezaan peringkat kedua di bawah:

$$2y''+6y'+16=10y'-4$$

[6 marks]

[6 *markah*]

CLO1 C3 (b) Solve the differential equation below by using an appropriate method.

Selesaikan persamaan pembezaan berikut dengan menggunakan kaedah yang sesuai.

i. $$\frac{4dy}{(x^2+1)dx}=\frac{1}{2y}$$

[4 marks]

[*4 markah*]

ii. $$\frac{dy}{dx}=\frac{6y^3+6x^3}{6xy^2}$$

[11 marks]

[*11 markah*]

SOALAN TAMAT

FORMULA SHEET FOR DBM3013 : ENGINEERING MATHEMATICS 3

DESCRIPTIVE STATISTICS		
Number of class	$k = 1+3.33 \log n$	
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	$s = \sqrt{\text{var } iance}$	

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	$x_0 = \frac{1}{y_2 - y_1}\begin{vmatrix} x_1 & y_1 \\ x_2 & y_2 \end{vmatrix}$	$x_{n+1} = x_n - \frac{f(x)}{f'(x)}$

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

SOLUTION FOR 1st ORDER DIFFERENTIAL EQUATION	
Homogeneous Equation $y = vx$ and $\frac{dy}{dx} = v + x\frac{dv}{dx}$	Linear Factors (Integrating Factors) $y \bullet IF = \int Q \bullet IF\, dx$ Where $IF = e^{\int P\, dx}$
	Logarithmic $a = e^{\ln a}$ $a^x = e^{x \ln a}$ $\int a^x\, dx = \frac{a^x}{\ln a} + c$

GENERAL SOLUTION FOR 2nd ORDER DIFFERENTIAL EQUATION	
Equation of the form $a\frac{d^2y}{dx^2} + b\frac{dy}{dx} + cy = 0$	
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.	$\frac{d}{dx}(k) = 0, k \text{ is constant}$	2.	$\frac{d}{dx}(x^n) = nx^{n-1}$ [Power Rule]
3.	$\frac{d}{dx}(ax^n) = anx^{n-1}$	4.	$\frac{d}{dx}(f(x) \pm g(x)) = f'(x) \pm g'(x)$
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.	$\frac{d}{dx}(e^{ax+b}) = e^{ax+b} \times \frac{d}{dx}(ax+b)$	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.	$\int ax^n dx = \frac{ax^{n+1}}{n+1} + c \;\; ;\{n \neq -1\}$	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.	$\int sec^2(ax+b)\ dx = \frac{1}{\frac{d}{dx}(ax+b)} \times \tan(ax+b) + c$		