

**SULIT**



**BAHAGIAN PEPERIKSAAN DAN PENILAIAN  
JABATAN PENDIDIKAN POLITEKNIK  
KEMENTERIAN PENDIDIKAN TINGGI**

**JABATAN MATEMATIK, SAINS & KOMPUTER**

**PEPERIKSAAN AKHIR**

**SESI JUN 2017**

**DBM3023 : ELECTRICAL ENGINEERING MATHEMATICS**

**TARIKH : 29 OKTOBER 2017**

**MASA : 2.30 PETANG - 4.30 PETANG (2 JAM)**

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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

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**JANGAN BUKA KERTAS SOALAN INI SEHINGGA DIARAHKAN**

(CLO yang tertera hanya sebagai rujukan)

**SULIT**

**SECTION A : 75 MARKS****BAHAGIAN A : 75 MARKAH****INSTRUCTION:**

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

**ARAHAN :**

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

**QUESTION 1****SOALAN 1**CLO2  
C2

- (a) The data below shows weight of 50 students.

*Data di bawah menunjukkan berat 50 orang pelajar.*

45	64	64	69	53	51	64	65	49	67
58	61	50	46	53	54	47	50	53	68
54	52	47	57	61	50	66	48	65	63
48	61	51	56	54	69	64	51	59	53
57	61	59	56	54	68	65	55	59	55

- i. Construct a Frequency Distribution Table for the data above by using size class of 4.

*Binakan Jadual Taburan Kekerapan bagi data di atas menggunakan saiz kelas 4.*

[5 marks]

[5 markah]

- ii. From the Frequency Table above, draw a histogram.  
 Daripada Jadual Kekeapan di atas, lukiskan histogram.

[5 marks]

[5 markah]

CLO2  
C3

(b)

- i. Based on the given data, calculate:  
 Berdasarkan data yang diberi, kirakan:

6 7 3 4 7 7 8 8 9

- a. Mean.  
 Min.

[3 marks]

[3 markah]

- b. Mode.  
 Mod.

[1 mark]

[1 markah]

- c. Median.  
 Median.

[2 marks]

[2 markah]

- ii. The recorded data in **Table 1(b)** is the number of residents living in each unit of an apartment. Give your answer to 4 decimal places.

Data yang direkodkan dalam **Jadual 1(b)** adalah bagi sejumlah penduduk yang tinggal dalam setiap unit di pangapuri. Berikan jawapan anda sehingga 4 titik perpuhan.

Class (x) Kelas	2	3	4	5	6	7	8
Frequency (f) Kekeapan	1	4	4	7	4	3	1

Table 1(b) / Jadual 1(b)

Calculate:

Kirakan:

- a. Mean.

Min.

[3 marks]

[3 markah]

- b. Mean Deviation.

Sisihan Min.

[3 marks]

[3 markah]

- c. Variance.

Varians.

[3 marks]

[3 markah]

## QUESTION 2

## SOALAN 2

CLO2  
C2

- (a) Two coins are tossed simultaneously. Express the probability of obtaining:  
*Dua syiling dilambung secara serentak. Nyatakan kebarangkalian mendapat:*

- i. Two heads.  
*Dua kepala.*

[3 marks]

[3 markah]

- ii. Two tails.  
*Dua ekor.*

[2 marks]

[2 markah]

- iii. No tail.  
*Tiada ekor.*

[1 mark]

[1 markah]

- iv. A head.  
*Satu kepala.*

[2 marks]

[2 markah]

- v. A head and a tail.  
*Satu kepala dan satu ekor.*

[2 marks]

[2 markah]

CLO2  
C3

- (b) i. There are three societies in a school. They are English Language Society (E), Malay Language Society (M) and Science Society (S). The information regarding students joining the societies is as follows:

*Terdapat tiga persatuan di sebuah sekolah. Persatuan tersebut adalah Persatuan Bahasa Inggeris (E), Persatuan Bahasa Melayu (M) dan Persatuan Sains (S). Maklumat mengenai pelajar yang menyertai persatuan adalah seperti berikut:*

$$P(E) = 0.4$$

$$P(E \cup M) = 0.65$$

$$P(E \cup S) = 0.8$$

$$P(E \cap M) = 0.15$$

$$P(E \cap S) = 0.2$$

$$P(M \cap S) = 0.2$$

$$P(E \cup M \cup S) = 0.95$$

A student is selected at random from the school. Calculate the probability that the student is a member of all three societies:

*Pelajar dipilih secara rawak daripada sekolah tersebut. Kirakan kebarangkalian pelajar adalah ahli ketiga-tiga persatuan:*

[5 marks]

[5 markah]

- ii. A and B are two events whereby  $P(B) = \frac{1}{5}$ ,  $P(B|A) = \frac{1}{3}$  and  $P(A|B) = \frac{1}{2}$ .

A dan B adalah dua peristiwa di mana  $P(B) = \frac{1}{5}$ ,  $P(B|A) = \frac{1}{3}$  dan  $P(A|B) = \frac{1}{2}$ .

- a. Determine whether A and B independent events?

Tentukan adakah A dan B peristiwa tidak bersandar?

[2 marks]

[2 markah]

- b. Determine whether A and B mutually exclusive events?

Tentukan adakah A dan B peristiwa saling eksklusif?

[2 marks]

[2 markah]

- c. Calculate  $P(A \cap B)$ .

Kirakan  $P(A \cap B)$ .

[2 marks]

[2 markah]

- d. Calculate  $P(A \cup B)$ .

Kirakan  $P(A \cup B)$ .

[4 marks]

[4 markah]

## QUESTION 3

## SOALAN 3

CLO2  
C2

- (a) By using the Definition  $F(s) = \int_0^{\infty} e^{-st} f(t) dt$ , compute the Laplace Transform of the given function below;

Dengan menggunakan,  $F(s) = \int_0^{\infty} e^{-st} f(t) dt$  dapatkan Jelmaan Laplace bagi fungsi di

bawah

i.  $f(t) = 2k$

[5 marks]

[5 markah]

ii.  $f(t) = \frac{e^{4t}}{2}$

[5 marks]

[5 markah]

CLO2  
C3

(b)

- i. Transform the functions below by using first shift theorem:

Dapatkan Jelmaan Laplace bagi fungsi di bawah:

a.  $f(t) = e^{2t} t^2$

[3 marks]

[3 markah]

b.  $f(t) = e^{-2t} \sinh 3t$

[4 marks]

[4 markah]

- ii. Find the Laplace transform by using multiplication by  $t^n$ , for  $f(t) = 2t \cos 4t$

Dapatkan Jelmaan Laplace dengan menggunakan 'multiplication by  $t^n$ ' untuk

$f(t) = 2t \cos 4t$ .

[8 marks]

[8 markah]

## QUESTION 4

## SOALAN 4

CLO 2  
C2

- (a) Determine the inverse Laplace Transform below:  
Tentukan songsangan Jelmaan Laplace yang berikut:

i. 
$$F(s) = \frac{5}{s+3} + \frac{5s}{s^2+16} - \frac{3}{s}$$

[2marks]  
[2 markah]

ii. 
$$F(s) = \frac{2s-2}{s^2+25}$$

[3 marks]  
[3 markah]

iii. 
$$F(s) = \frac{15}{s^2+4s+13}$$

[5 marks]  
[5 markah]

CLO2  
C3

- (b) By using the partial fraction, find the inverse Laplace Transform below:  
Dengan menggunakan kaedah pecahan separa, cari songsangan bagi Jelmaan Laplace berikut:

i. 
$$F(s) = \frac{2s-1}{s^2-5s+6}$$

[7 marks]  
[7 markah]

ii. 
$$F(s) = \frac{2s^2+7s+2}{s(s-1)^2}$$

[8 marks]  
[8 markah]

## SECTION B : 25 MARKS

## BAHAGIAN B : 25 MARKAH

## INSTRUCTION:

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

## ARAHAN:

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

## QUESTION 5

## SOALAN 5

CLO1  
C2

(a)

- i. Convert the following equation into AX=B form :  
Tukarkan persamaan berikut kepada bentuk AX=B :

a. 
$$\begin{aligned} 4y - 6z &= 5 \\ 3x + 6y - 9z &= -5 \\ -4x &= 4 \end{aligned}$$

[2 marks]  
[2 markah]

b. 
$$\begin{aligned} 2x + 6z + 2 &= 0 \\ x + 2y + 9z + 5 &= 0 \\ 6y - 6z &= 5 \end{aligned}$$

[2 marks]  
[2 markah]

- ii. Identify the real root by using the Newton Raphson method correct to 3 decimal places for  $f(x) = x^3 - x - 1$  where  $x_0 = \sqrt{2}$ .

*Kenalpasti punca sebenar dengan menggunakan kaedah Newton Raphson tepat kepada 3 titik perpuluhan bagi  $f(x) = x^3 - x - 1$  dimana  $x_0 = \sqrt{2}$ .*

[6 marks]

[6 markah]

CLO1  
C3

- (b) Calculate the value of  $x_1, x_2$  and  $x_3$  by using Crout Method.  
*Kira nilai  $x_1, x_2$  dan  $x_3$  dengan menggunakan kaedah Crout.*

$$2x_1 + x_2 + x_3 = 10$$

$$3x_1 + 2x_2 + 3x_3 = 18$$

$$x_1 + 4x_2 + 9x_3 = 16$$

[15 marks]

[15 markah]

## QUESTION 6

## SOALAN 6

CLO1  
C2

- (a) Compute the First Order Differential Equation below :  
*Kirakan Persamaan Pembezaan Pertama dibawah :*

i.  $xy^2 dx - x^2y^2 dy = 0$

[4 marks]

[4 markah]

ii.  $y' + \frac{x}{y} = 0$

[3 marks]

[3 markah]

iii.  $\sin x dx + y^2 dy = 0$

[3 marks]

[3 markah]

CLO1  
C3

- (b) i. Solve  $y' = \frac{y+x}{x}$  by using Homogeneous Equation Method.

*Selesaikan  $y' = \frac{y+x}{x}$  dengan menggunakan kaedah Persamaan Homogeneous.*

[5 marks]

[5 markah]

- ii. Solve the Second Order Differential Equation below :  
*Selesaikan Persamaan Pembezaan Kedua dibawah :*

a.  $y'' - y' - 2y = 0$

[4 marks]

[4 markah]

b.  $y'' - 3y' + 4y = 0$

[6 marks]

[6 markah]

## SOALAN TAMAT

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	$E = \frac{\sum  x - \bar{x} }{n}$	$E = \frac{\sum ( x - \bar{x}  f)}{\sum f}$
Variance	$s^2 = \frac{\sum (x - \bar{x})^2}{n}$	$s^2 = \frac{\sum x_i^2 - n\bar{x}^2}{n}$
	$s^2 = \frac{\sum [(x - \bar{x})^2 f]}{\sum f}$	$s^2 = \frac{\sum fx^2}{\sum f} - \left[ \frac{\sum fx}{\sum f} \right]^2$
Standard Deviation	$s = \sqrt{\text{variance}}$	

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

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

SOLUTION FOR 1 <sup>st</sup> ORDER DIFFERENTIAL EQUATION	
Homogeneous Equation $y = vx$ and $\frac{dy}{dx} = v + x \frac{dv}{dx}$	Linear Factors (Integrating Factors) $y \cdot IF = \int Q \cdot IF dx$ 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 2 <sup>nd</sup> ORDER DIFFERENTIAL EQUATION	
Equation of the form $a \frac{d^2 y}{dx^2} + b \frac{dy}{dx} + cy = 0$	
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:	$y = e^{\alpha x} (A \cos \beta x + B \sin \beta x)$



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LAPLACE TRANSFORM					
No.	$f(t)$	$F(s)$		$f(t)$	$F(s)$
1.	$a$	$\frac{a}{s}$	13.	$e^{-at} \sin \omega t$	$\frac{\omega}{(s+a)^2 + \omega^2}$
2.	$at$	$\frac{a}{s^2}$	14.	$e^{-at} \cos \omega t$	$\frac{s+a}{(s+a)^2 + \omega^2}$
3.	$t^n$	$\frac{n!}{s^{n+1}}$	15.	$\sinh \omega t$	$\frac{\omega}{s^2 - \omega^2}$
4.	$e^{at}$	$\frac{1}{s-a}$	16.	$\cosh \omega t$	$\frac{s}{s^2 - \omega^2}$
5.	$e^{-at}$	$\frac{1}{s+a}$	17.	$e^{at} \sinh \omega t$	$\frac{\omega}{(s-a)^2 - \omega^2}$
6.	$te^{-at}$	$\frac{1}{(s+a)^2}$	18.	$e^{-at} \sinh \omega t$	$\frac{\omega}{(s+a)^2 - \omega^2}$
7.	$t^n \cdot e^{at}, n=1,2,3$	$\frac{n!}{(s-a)^{n+1}}$	19.	$e^{-at} \cosh \omega t$	$\frac{s+a}{(s+a)^2 - \omega^2}$
8.	$t^n \cdot f(t)$	$(-1)^n \frac{d^n}{ds^n} [F(s)]$	20.	$f_1(t) + f_2(t)$	$F_1(s) + F_2(s)$
9.	$\sin \omega t$	$\frac{\omega}{s^2 + \omega^2}$	21.	$\int_0^t f(u) du$	$\frac{F(s)}{s}$
10.	$\cos \omega t$	$\frac{s}{s^2 + \omega^2}$	22.	$f(t-a)u(t-a)$	$e^{-as} F(s)$
11.	$t \sin \omega t$	$\frac{2\omega s}{(s^2 + \omega^2)^2}$	23.	First derivative $\frac{dy}{dt}, y'(t)$	$sY(s) - y(0)$
12.	$t \cos \omega t$	$\frac{s^2 - \omega^2}{(s^2 + \omega^2)^2}$	24.	Second derivative $\frac{d^2y}{dt^2}, y''(t)$	$s^2Y(s) - sy(0) - y'(0)$

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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.	$\int \sec^2(ax+b) dx = \frac{1}{\frac{d}{dx}(ax+b)} \times \tan(ax+b) + c$		