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) Table 1(a) shows types of sport played by students of a school. Based on the data given, draw:

Jadual 1(a) menunjukkan jenis-jenis sukan yang disertai oleh pelajar di sebuah sekolah. Berdasarkan data yang diberi, lukiskan:

Sports	Badminton	Football	Hockey	Tennis	Volleyball
Number of Students	65	90	50	30	65

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

i. Horizontal bar graph

Carta palang melintang

[5 marks]

[*5 markah*]

ii. Pie chart

Carta pai

[5 marks]

[*5 markah*]

CLO2
C3

(b) Table 1(b) shows the distribution frequency of time period taken by 100 students solving the mathematical problem.

Jadual 1(b) menunjukkan taburan kekerapan bagi masa yang diambil oleh 100 orang pelajar untuk menyelesaikan masalah matematik.

Time (minute)	Frequency
6-10	8
11-15	17
16-20	20
21-25	19
26-30	18
31-35	11
36-40	7

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

From the table above, find:
Daripada jadual di atas, cari:

i. Mean.
Min.

[3 marks]
[*3 markah*]

ii. Mean deviation.
Sisihan min.

[5 marks]
[5 *markah*]

iii. Standard deviation.
Sisihan piawai.

[7 marks]
[*7 markah*]

QUESTION 2
SOALAN 2

CLO2
C2

(a) i. A container contains of 20 red glasses, 32 blue glasses, 17 yellow glasses and 11 white glasses. A glass is picked randomly from the container. What is the probability of picking a blue glass?

Sebuah bekas mengandungi 20 gelas merah, 32 gelas biru, 17 gelas kuning and 11 gelas putih. Gelas dipilih secara rawak dari bekas. Apakah kebarangkalian untuk mengambil gelas biru?

[2 marks]
[*2 markah*]

ii. A roulette wheel is divided into 10 equal sectors labelled as P, O, L, I, T, E, K, N, I and K. The wheel is spun twice. Find the probability that the wheel stopped on the letter I on the first spin and the letter K on the second spin.

Sebuah roda rolet dibahagikan kepada 10 bahagian yang sama besar yang dilabelkan dengan P, O, L, I, T, E, K, N, I dan K. Roda dipusing sebanyak dua kali. Cari kebarangkalian roda berhenti pada huruf I pada pusingan pertama dan huruf K pada pusingan kedua.

[2 marks]
[*2 markah*]

iii. Table 2(a) below shows the number of donuts in a box. Two donuts are selected from the box. Without replacing the donuts, what is the probability of getting 1 chocolate donut and 1 pink donut?

Jadual 2(a) di bawah menunjukkan bilangan donat dalam sebuah kotak. Dua biji donat dipilih daripada kotak tersebut. Tanpa memasukkan semula, apakah kebarangkalian untuk mendapatkan 1 donat coklat dan 1 donat merah jambu?

Donuts /*Donat*	**Number of donuts/*Bilangan donat***
Original Donuts	9
Chocolates Donuts	12
Pink Donuts	10

Table 2(a) /*Jadual 2(a)*

[6 marks]

[*6 markah*]

CLO2 C3

(b) A survey was done at a secondary school. The students was asked "What is your favorite sport?" The results are summarized in Table 2(b) below:

Satu kaji selidik dijalankan di sebuah sekolah menengah. Pelajar telah ditanya soalan " Apakah sukan kegemaran anda? " Keputusan telah dirumuskan seperti di dalam Jadual 2(b) di bawah.

Sport House	**FootBall**	**Takraw**	**Softball**	**Total**
Hang Tuah	74	54	52	180
Hang Jebat	96	45	60	201
Hang Lekir	98	60	55	213

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

By using these students as a sample space, a student from this study is randomly selected. What is the probability that:

Dengan menggunakan pelajar ini sebagai ruang sampel, pelajar dipilih secara rawak. Apakah kebarangkaian jika:

i. Selecting a student whose favorite sport is takraw?
Memilih pelajar yang sukan kegemaran adalah takraw?

[3 marks]
[*3 markah*]

ii. Selecting a student from Hang Tuah sport house?
Memilih pelajar daripada rumah sukan Hang Tuah?

[3 marks]
[3 *markah*]

iii. The student selected is from Hang Jebat sport house and not prefer softball?
Memilih pelajar daripada rumah sukan Hang Jebat, yang tidak suka sofbal?

[5 marks]
[5 *markah*]

iv. The student selected is from Hang Lekir sport house and student prefers football or softball?
Memilih pelajar daripada rumah sukan Hang Lekir, yang suka bola sepak atau sofbal?

[4 marks]
[*4 markah*]

QUESTION 3

SOALAN 3

CLO2 C2

(a) State the Laplace Transform by using the definition $F(s) = \int_0^\infty e^{-st} f(t)dt.$

Nyatakan Jelmaan Laplace dengan menggunakan definisi $F(s) = \int_0^\infty e^{-st} f(t)dt.$

i. $f(t) = \frac{3}{5}$

[5 marks]

[*5 markah*]

ii. $f(t) = e^{-7t}$

[5 marks]

[*5 markah*]

CLO2 C3

(b) Find the Laplace Transform for the following by using the Laplace Transform Table:

Dapatkan Jelmaan Laplace bagi setiap yang berikut dengan menggunakan Jadual Jelmaan Laplace

i. $f(t) = (t-3)^2$

[4 marks]

[*4 markah*]

ii. $f(t) = -t^3 + 7t^2 - 1$

[3 marks]

[*3 markah*]

iii. $f(t) = 7\cos 3t - 3\sin 2t$

[4 marks]

[*4 markah*]

iv. $f(t) = \frac{e^{5t}}{3} - 2t + 7$

[4 marks]

[*4 markah*]

QUESTION 4

SOALAN 4

CLO2 C2

(a) Determine the following Inverse Laplace Transform:

Tentukan Jelmaan Laplace Songsang yang berikut:

i. $F(s)=\frac{4}{s+9}-\frac{2}{s-5}+\frac{7}{s}$

[5 marks]

[*5 markah*]

ii. $F(s)=\frac{9}{s^2+81}+\frac{4s}{s^2+81}-\frac{1}{(s+3)^2}$

[5 marks]

[*5 markah*]

CLO2 C3

(b) Find the Inverse Laplace Transform for the following expressions using the Partial Fraction method.

Dapatkan Jelmaan Laplace Songsang untuk yang berikut dengan menggunakan kaedah Pecahan Separa.

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

[7 marks]

[*7 markah*]

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

[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) By using Newton-Raphson method, determine the root for $5x^2 - 4x^{\frac{3}{2}} - 6 = 0$. Given $x_0 = 1.5$. Give the answer correct to four decimal places.

Dengan menggunakan Kaedah Newton-Raphson, tentukan punca persamaan $5x^2 - 4x^{\frac{3}{2}} - 6 = 0$. $Diberi\ x_0 = 1.5$. *Berikan jawapan yang betul untuk empat titik perpuluhan.*

[10 marks]

[*10 markah*]

CLO1
C3

(b) Find the matrix L and U for the equation below using Doolittle Method.

Dapatkan matrix L dan U untuk persamaan di bawah menggunakan Kaedah Doolittle.

$$s + 4t - 2u = 3$$
$$3s - 2t + 5u = 14$$
$$2s + 3t + u = 11$$

[15 marks]

[*15 markah*]

QUESTION 6

SOALAN 6

CLO1 C2 (a) Use linear equation method to solve the first order differential equation.
Gunakan kaedah persamaan linear untuk selesaikan persamaan pembezaan peringkat pertama berikut.

$$2\frac{dy}{dx} + 4y = 2e^{3x}$$

[10 marks]
[*10 markah*]

CLO1 C3 (b) Solve the following second order differential equations.
Selesaikan persamaan pembezaan peringkat kedua yang berikut.

i. $\frac{d^2y}{dx^2} - 3\frac{dy}{dx} + 2 = 0$

[4 marks]
[*4 markah*]

ii. $6\frac{d^2y}{dx^2} - 5\frac{dy}{dx} + 1 = 0$

[4 marks]
[*4 markah*]

iii. $\frac{d^2y}{dx^2} + 2\frac{dy}{dx} + 3 = 0$

[7 marks]
[*7 markah*]

SOALAN TAMAT

FORMULA DBM3023- ELECTRICAL ENGINEERING MATHEMATICS

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:	$y = e^{\alpha x}(A\cos\beta x + B\sin\beta x)$

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.	$t^n.e^{at}$, 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.	$t^n.f(t)$	$(-1)^n\frac{d^n}{ds^n}[F(s)]$	20.	$f_1(t)+f_2(t)$	$F_1(s)+F_2(s)$
9.	$\sin\omega t$	$\frac{\omega}{s^2+\omega^2}$	21.	$\int_o^t f(u)du$	$\frac{F(s)}{s}$
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 $\frac{d^2y}{dt^2}, y''(t)$	$s^2Y(s)-sy(0)-y'(0)$

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.	$\frac{d}{dx}\big(f(x) \pm g(x)\big) = f'(x) \pm g'(x)$
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.	$\frac{d}{dx}\left(e^{ax+b}\right) = e^{ax+b} \times \frac{d}{dx}(ax+b)$	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.	$\int ax^n dx = \frac{ax^{n+1}}{n+1} + c \quad ;\{n \neq -1\}$	2.	$\int (ax+b)^n dx = \frac{(ax+b)^{n+1}}{(a)(n+1)} + c\,;\{n \neq -1\}$
3.	$\int k\ dx = kx + c, k \text{ is constant}$	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.	$\int sec^2(ax+b)\ dx = \frac{1}{\frac{d}{dx}(ax+b)} \times \tan(ax+b) + c$		