SULIT

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

JABATAN MATEMATIK, SAINS & KOMPUTER

PEPERIKSAAN AKHIR

**SESI II : 2021/2022**

# DBM30043: ELECTRICAL ENGINEERING MATHEMATICS

**TARIKH : 29 JUN 2022**
**MASA : 08.30 PAGI – 10.30 PAGI (2 JAM)**

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Kertas ini mengandungi **LAPAN (8)** halaman bercetak.

Struktur (4 soalan)

Dokumen sokongan yang disertakan : Formula

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

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

Table 1a / *Jadual 1a*

| Time (minute)<br>*Masa (minit)* | Number of students<br>*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 shows the number of students in three groups. A student is chosen randomly from each group. Determine the probability of choosing:
*Jadual 2 menunjukkan bilangan pelajar dalam tiga kumpulan. Seorang pelajar dipilih secara rawak dari setiap kumpulan. Tentukan kebarangkalian memilih:*

Table 1b / *Jadual 1b*

| Group<br>*Kumpulan* | Number of boys<br>*Bilangan lelaki* | Number of girls<br>*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*]

CLO1
C3

(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***

CLO1
C3

(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*]

CLO1
C3

(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) i. Determine the Laplace Transform for $f(t) = \frac{5}{2e^{5t}}$ using the definition of Laplace Transform, $F(s) = \int_0^\infty e^{-st} f(t)\, dt$ .

*Tentukan Jelmaan Laplace bagi* $f(t) = \frac{5}{2e^{5t}}$ *menggunakan definisi Jelmaan Laplace ,* $F(s) = \int_0^\infty e^{-st} f(t)\, dt$ .

[5 marks]

[*5 markah*]

ii. Determine the Laplace Transform for all the following functions by using the Laplace Transform table:

*Tentukan Jelmaan Laplace bagi semua fungsi yang berikut dengan menggunakan Jadual Jelmaan Laplace.*

a. $f(t) = t^2 e^{3t}$

[2 marks]

[*2 markah*]

b. $f(t) = 4\, e^{-3t} \sin 4t$

[3 marks]

[*3 markah*]

c. $f(t) = 2 + \sinh 5t - t^3 + t \cos 6t$

[5 marks]

[*5 markah*]

CLO1
C3

(b) Solve the Inverse Laplace Transform using the partial fraction method for the following function:

*Selesaikan Jelmaan Laplace Songsang menggunakan kaedah pecahan separa bagi fungsi berikut :*

$$F(s) = \frac{s+5}{s^2 - s - 12}$$

[10 marks]

[*10 markah*]

**SOALAN TAMAT**

**FORMULA DBM30043 - ELECTRICAL ENGINEERING MATHEMATICS**

<table>
<tr><th colspan="3">DESCRIPTIVE STATISTICS</th></tr>
<tr><td>Number of class</td><td>Sturges Rule, $k = 1 + 3.33 \log n$</td><td>Rule of Thumb, $2^k > n$</td></tr>
<tr><td>Mean</td><td>$\bar{x} = \frac{\sum x}{n}$</td><td>$\bar{x} = \frac{\sum (fx)}{\sum f}$</td></tr>
<tr><td>Median</td><td colspan="2">$Median = L_m + \left(\frac{\frac{N}{2} - F}{f_m}\right) C$</td></tr>
<tr><td>Mode</td><td colspan="2">$Mode = L_{M_o} + \left(\frac{d_1}{d_1 + d_2}\right) C$</td></tr>
<tr><td>Quartile</td><td colspan="2">$Q_k = L_{Q_k} + \left(\frac{\frac{kN}{4} - F}{f_{Q_k}}\right) C; \quad k = 1, 2, 3$</td></tr>
<tr><td>Decile</td><td colspan="2">$D_k = L_{D_k} + \left(\frac{\frac{kN}{10} - F}{f_{D_k}}\right) C; \quad k = 1, 2, 3 \ldots 9$</td></tr>
<tr><td>Percentile</td><td colspan="2">$P_k = L_{P_k} + \left(\frac{\frac{kN}{100} - F}{f_{P_k}}\right) C; \quad k = 1, 2, 3 \ldots 99$</td></tr>
<tr><td>Mean Deviation</td><td>$E = \frac{\sum \left| x - \bar{x} \right|}{n}$</td><td>$E = \frac{\sum \left( \left| x - \bar{x} \right| f \right)}{\sum f}$</td></tr>
<tr><td rowspan="2">Variance</td><td>$s^2 = \frac{\sum \left( x - \bar{x} \right)^2}{n}$</td><td>$s^2 = \frac{\sum_{i=1}^{n} x_i^{\,2} - n\bar{x}^2}{n}$</td></tr>
<tr><td>$s^2 = \frac{\sum \left[ \left( x - \bar{x} \right)^2 f \right]}{\sum f}$</td><td>$s^2 = \frac{\sum fx^2}{\sum f} - \left[ \frac{\sum fx}{\sum f} \right]^2$</td></tr>
<tr><td>Standard Deviation</td><td colspan="2">$s = \sqrt{variance}$</td></tr>
</table>

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

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

| SOLUTION FOR 1st ORDER DIFFERENTIAL EQUATION | |
|---|---|
| **Logarithmic**<br>$a = e^{\ln a}$<br>$a^x = e^{x \ln a}$<br>$\int a^x\,dx=\frac{a^x}{\ln a}+c$ | **Homogeneous Equation**<br>$y=vx$ and $\frac{dy}{dx}=v+x\frac{dv}{dx}$<br>**Linear Factors (Integrating Factors)**<br>$\frac{dy}{dx}+Py=Q$<br>$y\bullet IF=\int Q\bullet IF\,dx$<br>Where $IF=e^{\int P\,dx}$ |
| **GENERAL SOLUTION FOR 2nd ORDER DIFFERENTIAL EQUATION** | |
| Equation of the form | $a\frac{d^2y}{dx^2}+b\frac{dy}{dx}+cy=0$ |
| Quadratics Formula | $x=\frac{-b\pm\sqrt{b^2-4ac}}{2a}$ |
| 1. Real & different roots | $y=Ae^{m_1x}+Be^{m_2x}$ |
| 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. | $f(t)$ | $F(s)$ | No. | $f(t)$ | $F(s)$ |
| 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. | $\frac{d}{dx}(k) = 0\,, \qquad k\ is\ constant$ | 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. | $\int sec^2(ax+b)\, dx = \frac{1}{a} \times \ \tan(ax+b) + c$ | | |