SULIT

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 & KOMPUTER

PEPERIKSAAN AKHIR

**SESI I : 2025/2026**

# DBM30193 : ELECTRICAL ENGINEERING MATHEMATICS

**TARIKH : 24 NOVEMBER 2025**
**MASA : 8.30 PAGI - 10.30 PAGI (2 JAM)**

---

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

Struktur (4 soalan)

Dokumen sokongan yang disertakan : Formula

---

**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 struktur. Jawab **SEMUA** soalan.*

**QUESTION 1**

***SOALAN 1***

CLO1 (a) Based on the data given:

*Berdasarkan data yang diberi:*

$$5\,,\ 7,\ 10\,,\ 11,\ (2x+3)$$

i. Calculate the value of $x$, if the mean of the data is 10

*Kira nilai x, jika min data adalah 10*

[2 marks]

[*2 markah*]

ii. Then, compute the median of the data

*Setelah itu, hitung nilai median bagi data tersebut*

[3 marks]

[*3 markah*]

iii. Calculate the standard deviation

*Kira sisihan piawai*

[5 marks]

[*5 markah*]

CLO2 (b) A group of Engineering students conducted an experiment to measure the electric consumption of industrial motors over one hour of operation. The data below shows the energy usage for 50 electric motors:

*Sekumpulan pelajar Kejuruteraan telah menjalankan satu eksperimen bagi mengukur penggunaan tenaga motor industri dalam tempoh satu jam operasi. Data di bawah menunjukkan penggunaan tenaga bagi 50 buah motor elektrik:*

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

| Electric Consumption (kWh) *Penggunaan Elektrik (kWh)* | Number of Motors *Bilangan Motor* |
|---|---|
| 10 - 14 | 6 |
| 15 - 19 | 7 |
| 20 - 24 | 14 |
| 25 - 29 | 12 |
| 30 - 34 | 8 |
| 35 - 39 | 3 |

Calculate:

*Kira:*

i. Mean

*Min*

[5 marks]

[*5 markah*]

ii. Median

*Median*

[5 marks]

[*5 markah*]

CLO2 (c) A circuit board contains 20 capacitors, and 4 of them are defective. If 3 capacitors are selected at random **without replacement**, calculate the probability that all selected capacitors are non-defective.

*Sebuah papan litar mengandungi 20 kapasitor, dan 4 daripadanya rosak. Jika 3 kapasitor dipilih secara rawak **tanpa gantian**, kira kebarangkalian semua kapasitor yang dipilih masih baik.*

[5 marks]

[*5 markah*]

**QUESTION 2**

***SOALAN 2***

CLO 2

(a) Based on the following linear equation:

*Berdasarkan persamaan linear yang berikut:*

$$3x + 2y + z = 1$$
$$5x + 3y = 2 - 4z$$
$$x + y - z = 1$$

i. Calculate matrix L and U by using the Crout Method

*Kirakan matriks L dan U menggunakan Kaedah Crout*

[10 marks]

[*10 markah*]

ii. Then, compute the value of *x, y* and *z*

*Kemudian, hitung nilai x, y dan z*

[8 marks]

[*8 markah*]

CLO 1

(b) Calculate the roots of the equation $x^4 - 5x^3 + 9x + 3 = 0$ correct to **3 decimal places** by using the Newton Raphson Method. Given that $x_0 = 5$.

*Kirakan punca bagi persamaan* $x^4 - 5x^3 + 9x + 3 = 0$ *betul kepada* ***3 tempat perpuluhan*** *menggunakan kaedah Newton Raphson. Diberi* $x_0 = 5$.

[7 marks]

[*7 markah*]

**QUESTION 3**

***SOALAN 3***

CLO2 (a) Calculate the following first order differential equations by using the given methods:

*Kirakan persamaan pembezaan peringkat pertama berikut dengan menggunakan kaedah yang diberikan:*

i. $\frac{dy}{dx} = 9x^2 + \frac{3}{x} - 5$ ; Direct Integration Method
; *Kaedah Kamiran Terus*

[3 marks]
[*3 markah*]

ii. $4x\frac{dy}{dx} = (y - 2)$ ; Separating the Variables Method
; *Kaedah Pemisah Pemboleh Ubah*

[4 marks]
[*4 markah*]

iii. $\frac{dy}{dx} = \frac{yx + y^2}{x^2}$ ; Homogeneous Method
; *Kaedah homogen*

[8 marks]
[*8 markah*]

CLO1 (b) Solve the following second order differential equations:

*Selesaikan persamaan pembezaan peringkat kedua berikut:*

i. $6\frac{d^2y}{dx^2} = 35y - 11\frac{dy}{dx}$

[5 marks]
[*5 markah*]

ii. $6\frac{d^2y}{dx^2} + 10y = 8\frac{dy}{dx}$

[5 marks]
[*5 markah*]

**QUESTION 4**

***SOALAN 4***

CLO1 (a) Calculate the following Laplace Transform by using the stated methods:

*Kirakan Jelmaan Laplace berikut menggunakan kaedah yang dinyatakan:*

i. $\mathcal{L}\{\cos 6t + e^{-3t} - 2t\}$ ; Table of Laplace Transform
; *Jadual Jelmaan Laplace*

[3 marks]
[*3 markah*]

ii. $\mathcal{L}\{e^{t} \sin 4t\}$ ; First Shift Theorem
; *Teorem Anjakan Pertama*

[3 marks]
[*3 markah*]

iii. $\mathcal{L}\{t^2 e^{-5t}\}$ ; Multiplication with $t^n$
; *Pendaraban dengan* $t^n$

[4 marks]
[*4 markah*]

CLO2 (b) Calculate the following Inverse Laplace Transform by using the stated methods:
*Selesaikan Jelmaan Laplace Songsang yang berikut menggunakan kaaedah yang dinyatakan:*

i. $F(s) = \frac{s}{s^2 - 25} + \frac{2}{s - 3} - \frac{4}{s}$ ; Table of Laplace Transform
; *Jadual Jelmaan Laplace*

[3 marks]
[*3 markah*]

ii. $F(s) = \frac{3s - 16}{s^2 + 4}$ ; Table of Laplace Transform
; *Jadual Jelmaan Laplace*

[4 marks]
[*4 markah*]

iii. $F(s) = \frac{5s}{(s - 4)(s + 1)}$ ; Partial Fraction Method
; *Kaedah Pecahan Separa*

[8 marks]
[*8 markah*]

**SOALAN TAMAT**

**FORMULA DBM30193 - ELECTRICAL ENGINEERING MATHEMATICS**

| DESCRIPTIVE STATISTICS | | |
|---|---|---|
| Mean | $\overline{x} = \frac{\sum x}{n}$ | $\overline{x} = \frac{\sum(fx)}{\sum f}$ |
| 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 | $s^2 = \frac{\sum(x - \overline{x})^2}{n}$ | $s^2 = \frac{\sum_{i=l}^{n} {x_i}^2 - n\overline{x}^2}{n}$ |
| | $s^2 = \frac{\sum[(x - \overline{x})^2 f]}{\sum f}$ | $s^2 = \frac{\sum fx^2}{\sum f} - \left[\frac{\sum fx}{\sum f}\right]^2$ |
| Standard Deviation | $s = \sqrt{variance}$ | |

## NUMERICAL METHOD

| | | |
|---|---|---|
| Crout Method | $A = \begin{pmatrix} l_{11} & 0 & 0 \\ l_{21} & l_{22} & 0 \\ l_{31} & l_{32} & l_{33} \end{pmatrix} \begin{pmatrix} 1 & u_{12} & u_{13} \\ 0 & 1 & u_{23} \\ 0 & 0 & 1 \end{pmatrix}$ | $Ly = b$<br>$Ux = y$ |
| 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 | $x_{n+1} = x_n - \frac{f(x_n)}{f'(x_n)}$ | |
| 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**

$a = e^{\ln a}$

$a^x = e^{x \ln a}$

$\int a^x \, dx = \frac{a^x}{\ln a} + c$

**Homogeneous Equation**

$y = vx$ and $\frac{dy}{dx} = v + x\frac{dv}{dx}$

**Linear Factors (Integrating Factors)**

$\frac{dy}{dx} + Py = Q$

$y \cdot \mathrm{IF} = \int Q \cdot \mathrm{IF} \, dx$

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 | $y = Ae^{m_1 x} + Be^{m_2 x}$ |
| 2. 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. | $\boldsymbol{a}$ | $\boldsymbol{\frac{a}{s}}$ | 13. | $\boldsymbol{e^{-at}}\ sin\ \omega t$ | $\boldsymbol{\frac{\omega}{(s+a)^2+\omega^2}}$ |
| 2. | $\boldsymbol{at}$ | $\boldsymbol{\frac{a}{s^2}}$ | 14. | $\boldsymbol{e^{-at}}cos\ \omega t$ | $\boldsymbol{\frac{s+a}{(s+a)^2+\omega^2}}$ |
| 3. | $\boldsymbol{t^n}$ | $\boldsymbol{\frac{n!}{s^{n+1}}}$ | 15. | $\sinh \omega t$ | $\boldsymbol{\frac{\omega}{s^2-\omega^2}}$ |
| 4. | $\boldsymbol{e^{at}}$ | $\boldsymbol{\frac{1}{s-a}}$ | 16. | $\cosh \omega t$ | $\boldsymbol{\frac{s}{s^2-\omega^2}}$ |
| 5. | $\boldsymbol{e^{-at}}$ | $\boldsymbol{\frac{1}{s+a}}$ | 17. | $\boldsymbol{e^{at}}\ sinh\ \omega t$ | $\boldsymbol{\frac{\omega}{(s-a)^2-\omega^2}}$ |
| 6. | $\boldsymbol{te^{-at}}$ | $\boldsymbol{\frac{1}{(s+a)^2}}$ | 18. | $\boldsymbol{e^{-at}}\ sinh\ \omega t$ | $\boldsymbol{\frac{\omega}{(s+a)^2-\omega^2}}$ |
| 7. | $t^n.e^{at}, n = 1,2,3$ | $\frac{n!}{(s-a)^{n+1}}$ | 19. | $\boldsymbol{e^{-at}}\ cosh\ \omega t$ | $\boldsymbol{\frac{s+a}{(s+a)^2-\omega^2}}$ |
| 8. | $t^n.f(t)$ | $(-1)^n\frac{d^n}{ds^n}[F(s)]$ | 20. | $\boldsymbol{f_1(t)+f_2(t)}$ | $\boldsymbol{F_1(s)+F_2(s)}$ |
| 9. | $sin\ \omega t$ | $\boldsymbol{\frac{\omega}{s^2+\omega^2}}$ | 21. | $\boldsymbol{\int_0^t f(u)\,du}$ | $\boldsymbol{\frac{F(s)}{s}}$ |
| 10. | $cos\ \omega t$ | $\boldsymbol{\frac{s}{s^2+\omega^2}}$ | 22. | $\boldsymbol{f(t-a)u(t-a)}$ | $\boldsymbol{e^{-as}F(s)}$ |
| 11. | $t\ sin\ \omega t$ | $\boldsymbol{\frac{2\omega s}{(s^2+\omega^2)^2}}$ | 23. | First derivative $\boldsymbol{\frac{dy}{dt}}, y'(t)$ | $\boldsymbol{sY(s)-y(0)}$ |
| 12. | $t\ cos\ \omega t$ | $\boldsymbol{\frac{s^2-\omega^2}{(s^2+\omega^2)^2}}$ | 24. | Second derivative $\boldsymbol{\frac{d^2y}{dt^2}}, y''(t)$ | $\boldsymbol{s^2Y(s)-sy(0)-y'(0)}$ |

| 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. | $\frac{d}{dx}(ax+b)^n = n(ax+b)^{n-1} \times \frac{d}{dx}(ax+b)\quad [Composite\ Rule]$ | | |
| 4. | $\frac{d}{dx}\big(f(x) \pm g(x)\big) = f'(x) \pm g'(x)$ | 5. | $\frac{d}{dx}(uv) = u\frac{dv}{dx} + v\frac{du}{dx}\quad [Product\ Rule]$ |
| 6. | $\frac{d}{dx}\left(\frac{u}{v}\right) = \frac{v\frac{du}{dx} - u\frac{dv}{dx}}{v^2}\quad [Quotient\ Rule]$ | 7. | $\frac{dy}{dx} = \frac{du}{dx} \times \frac{dy}{du}\quad [Chain\ Rule]$ |
| 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. | $\int \sin(ax+b)\ dx = -\frac{1}{a} \times \cos(ax+b) + c$ | | |
| 13. | $\int \cos(ax+b)\ dx = \frac{1}{a} \times sin\,(ax+b) + c$ | | |
| 14. | $\int sec^2(ax+b)\ dx = \frac{1}{a} \times \tan(ax+b) + c$ | | |