Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER I
SESSION 2016/2017

COURSE NAME	:	TECHNICAL MATHEMATICS I
COURSE CODE	:	DAS 11003
PROGRAMME CODE	:	1 DAK
EXAMINATION DATE	:	DECEMBER 2016 / JANUARY 2017
DURATION	:	3 HOURS
INSTRUCTION	:	SECTION A: ANSWER ALL QUESTION SECTION B: ANSWER ANY THREE (3) QUESTIONS

THIS QUESTION PAPER CONSISTS OF SIX (6) PAGES

SECTION A

Q1 (a) Find the sum of the sequence $\sum_{k=1}^{7}\left(k^2+6k-19\right)$.

(5 marks)

(b) (i) Given the sequence 54, 18, 6, ... State the the formula for the nth term and nth sum.

(8 marks)

(ii) Based on the formulae for nth sum in b (i), find the sum of 5th terms of the sequence.

(2 marks)

(c) The sum of the first 11 terms of an arithmetic sequence is 110 and the sum of the first 20 terms is 290. Find the 11th and 20th terms of the sequence

(10 marks)

SECTION B

Q2 (a) Simplify

(i) $\left(\dfrac{xy^{-1}}{x^{-4}yz^{2}}\right)^{-3}\left(\dfrac{3x^{2}}{yz}\right)^{2}$.

(ii) $\sqrt[3]{16xy^{2}z^{3}}\cdot\sqrt[3]{4y^{5}z}$.

(8 marks)

(b) Rationalize denominator of the expression $\dfrac{2}{\sqrt[3]{x}}$.

(3 marks)

(c) Solve the equation $2-\dfrac{6}{\sqrt{5}+3}$ to the simplest form.

(4 marks)

(d) Solve $7x^{\frac{1}{2}}+2=0$ for x value

(3 marks)

(e) (i) Express $3\log x-2\log(xy)+\log y$ as a single logarithm.

(ii) Find the value of $\log_4 8+\log_4 2-\log_{16} 64$

(7 marks)

Q3 (a) Given that $A = 5x^2 - 3$ and $B = x^3 - x + 2$. Evaluate

(i) $A^2 - xB$

(ii) $5B \div A$

(7 marks)

(b) Solve the inequality $x^3 \geq 2x^2 + 3x$

(7 marks)

(c) Express $\dfrac{-2(2x^2 - x + 6)}{(x^2 + 2)(x + 1)}$ into partial fraction

(6 marks)

(d) Find the roots of $x^3 - 5x^2 - 4x + 3 = 0$ in between [0 , 1] by using Secant Method. Iterate until $|f(x_i)| < 0.005$.

(5 marks)

Q4 (a) Find the exact value of $3 - \cos 240° + \sin^2 - 45°$

(4 marks)

(b) Given that $\cos 36° = 0.8090$, find

(i) $\sin 36°$

(ii) $\sin 54°$

(ii) $\cos 18°$

(8 marks)

(c) Given that $\sin\alpha = \dfrac{2}{3}$ and α lies in quadrant II. Evaluate

(i) $\sin 2\alpha$

(ii) $\cos 4\alpha$

(7 marks)

(d) Solve $3\sin\theta\cos^2\theta = 2\sin\theta$ for all θ value in between $0° \leq \theta \leq 360°$.

(6 marks)

Q5 (a) If $A = \begin{pmatrix} 2 & 3 & -1 \\ 4 & 5 & 2 \end{pmatrix}$, $B = \begin{pmatrix} 1 & 4 \\ 5 & -1 \end{pmatrix}$ and $C = \begin{pmatrix} 2 & -1 \\ 3 & -1 \\ 4 & 2 \end{pmatrix}$. Evaluate

(i) $A - 2C^T$

(ii) $(CB)^T - A$

(iii) $\frac{1}{2}CA$

(11 marks)

(b) Given that $D = \begin{pmatrix} 4 & x & 1 \\ -1 & 2 & 0 \\ -1 & 1 & 1 \end{pmatrix}$, find the value of x if determinant D, $|D| = 0$

(4 marks)

(c) Given a linear equation system

$$\begin{aligned} x + y + z &= 5 \\ 2x + 3y + 5z &= 8 \\ 4x + 5z &= 2 \end{aligned}$$

(i) Write the system into augmented matrix, $[A|B]$

(ii) Do row operation one after another as given below:

$R_2 - 2R_1 \rightarrow R_2$

$R_3 - 4R_1 \rightarrow R_3$

$R_3 + 4R_2 \rightarrow R_3$

$\frac{R_3}{13} \rightarrow R_3$

(iii) Continue the row operation from **Q5(c)(ii)** to find the value of x, y and z.

(10 marks)

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-END OF QUESTIONS –

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Exponent, Radical & Logarithms

i) $x^m . x^n = x^{m+n}$

ii) $\dfrac{x^m}{x^n} = x^{m-n}$

iii) $(x^m)^n = x^{mn}$

iv) $x^{p/q} = \left(\sqrt[q]{x}\right)^p$

v) $x = b^n \Leftrightarrow \log_b x = n$

vi) $\log_b(xy) = \log_b x + \log_b y$

vii) $\log_b\left(\dfrac{x}{y}\right) = \log_b x - \log_b y$

viii) $\log_b x^k = k \log_b x$

ix) $\log_a x = \dfrac{\log_b x}{\log_b a}$

Polynomial

i) $x = \dfrac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

ii)
$$x^2 + bx + c = x^2 + bx + \left(\frac{b}{2}\right)^2 - \left(\frac{b}{2}\right)^2 + c$$
$$= \left(x + \frac{b}{2}\right)^2 - \left(\frac{b}{2}\right)^2 + c$$

iii) $x_{i+2} = \dfrac{x_i f(x_{i+1}) - x_{i+1} f(x_i)}{f(x_{i+1}) - f(x_i)}$

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Sequence & Series

i) $\sum_{k=1}^{n} c = cn$

ii) $\sum_{k=1}^{n} k = \dfrac{n(n+1)}{2}$

iii) $\sum_{k=1}^{n} k^2 = \dfrac{n(n+1)(2n+1)}{6}$

Arithmetic Series

i) $T_n = a + (n-1)d$

$d = u_n - u_{n-1}$

ii) $S_n = \dfrac{n}{2}(a + u_n)$

iii) $S_n = \dfrac{n}{2}[2a + (n-1)d]$

Geometric Series

i) $T_n = ar^{n-1}$

ii) $r = \dfrac{u_n}{u_{n-1}}$

iii) $S_n = \dfrac{a(1-r^n)}{1-r}$

iv) $S_\infty = \dfrac{a}{1-r}$

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Trigonometric Identity

i) $\cos^2\theta + \sin^2\theta = 1$

ii) $1 + \tan^2\theta = \sec^2\theta$

iii) $\cot^2\theta + 1 = \csc^2\theta$

Addition and Subtraction Formulas:

i) $\sin(\alpha \pm \beta) = \sin\alpha\cos\beta \pm \cos\alpha\sin\beta$

ii) $\cos(\alpha \pm \beta) = \cos\alpha\cos\beta \mp \sin\alpha\sin\beta$

iii) $\tan(\alpha \pm \beta) = \dfrac{\tan\alpha \pm \tan\beta}{1 \mp \tan\alpha\tan\beta}$

Double - Angle Formulas

i) $\sin 2\theta = 2\sin\theta\cos\theta$

ii) $\cos 2\theta = \cos^2\theta - \sin^2\theta$

OR $\cos 2\theta = 2\cos^2\theta - 1$

OR $\cos 2\theta = 1 - 2\sin^2\theta$

iii) $\tan 2\theta = \dfrac{2\tan\theta}{1 - \tan^2\theta}$

Half – Angle Formulas

i) $\sin\dfrac{\theta}{2} = \pm\sqrt{\dfrac{1-\cos\theta}{2}}$

ii) $\cos\dfrac{\theta}{2} = \pm\sqrt{\dfrac{1+\cos\theta}{2}}$

iii) $\tan\dfrac{\theta}{2} = \pm\sqrt{\dfrac{1-\cos\theta}{1+\cos\theta}}$

Matrices

$$A = \begin{pmatrix} a_{11} & a_{12} & a_{13} \\ a_{21} & a_{22} & a_{23} \\ a_{31} & a_{32} & a_{33} \end{pmatrix}, \quad |A| = a_{11}\begin{vmatrix} a_{22} & a_{23} \\ a_{32} & a_{33} \end{vmatrix} - a_{12}\begin{vmatrix} a_{21} & a_{23} \\ a_{31} & a_{33} \end{vmatrix} + a_{13}\begin{vmatrix} a_{21} & a_{22} \\ a_{31} & a_{32} \end{vmatrix}$$

$$Adj(A) = (c_{ij})^T$$

$$A^{-1} = \frac{1}{|A|}Adj(A)$$