UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER I
SESSION 2012/2013

COURSE NAME	:	TECHNICAL MATHEMATICS I
COURSE CODE	:	DAS 11003
PROGRAMME	:	1 DAB/ DAJ/ DAR
EXAMINATION DATE	:	OCTOBER 2012
DURATION	:	3 HOURS
INSTRUCTIONS	:	ANSWER **ALL** QUESTIONS IN **PART A & THREE (3)** QUESTIONS IN **PART B**

THIS QUESTION PAPER CONSISTS OF SEVEN (7) PAGES

PART A

Q1 (a) Let $A=\begin{pmatrix}-4 & 1 & -1\\ 2 & 3 & -2\end{pmatrix}$ $B=\begin{pmatrix}-2 & 6 & 1\\ 1 & -3 & 1\end{pmatrix}$ $C=\begin{pmatrix}-2 & 3 & 0\\ 1 & -1 & 2\\ -3 & 4 & 1\end{pmatrix}$.

Find the value of

(i) $4A+B$

(ii) $-2B^T - A^T$

(iii) $2A^T B$

(10 marks)

(b) Given a system of equations:

$$\begin{aligned} x - 2y - z &= 1 \\ -x + 3y + 3z &= 4 \\ 2x - 3y + z &= 10 \end{aligned}$$

(i) Write a system into matrix equation, $AX = B$

(ii) Find the matrix determinant, $|A|$

(iii) Find adjoint, *Adj A*

(iv) Find the inverse of the matrix, A^{-1}

(v) Find *x, y* and *z* by using (iii) **OR** Gauss-Jordan Elimination Method

(15 marks)

PART B

Q2 (a) Express the expressions in simplest form with only positive exponents.

(i) $\left(\dfrac{3a^2}{4b}\right)^{-3}\left(\dfrac{4}{a}\right)^{-5}$

(ii) $\dfrac{ax^{-2}+a^{-2}x}{a^{-1}+x^{-1}}$

(9 marks)

(b) Perform the indicated operations of radicals and express each radical in simplest form.

(i) $3\sqrt{75x}+2\sqrt{48x}-2\sqrt{18x}$

(ii) $\sqrt{\dfrac{1}{2}}+\sqrt{\dfrac{25}{2}}-4\sqrt{18}$

(8 marks)

(c) Solve for y in terms of x.

(i) $\log_3 y=\frac{1}{2}\log_3 7+\frac{1}{2}\log_3 x$

(ii) $3\ln y=2+3\ln x$

(8 marks)

Q3 (a) (i) Factor completely: x^4-81

(ii) Solve for x: $x^2-6x+4=0$

(8 marks)

(b) Write $\dfrac{x-18}{x(x-3)^2}$ in partial fraction form

(7 marks)

(c) Solve the inequality $\frac{(x+3)(x-2)}{(x+1)} \leq 0$

(5 marks)

(d) Find the root of $f(x) = 2x^3 - 5x^2 - 7x + 6$ by using Secant Method in $[3,3.5]$ interval. Iterate until $|f(x_i)| \leq 0.005$ (4 decimal places).

(5 marks)

Q4 (a) Evaluate this series using a formula: $\sum_{k=1}^{14}\left(1-2k+3k^2\right)$

(7 marks)

(b) Given $-8,\ -5,\ -2,\ \ldots,\ +7$.

(i) Determine whether this is an arithmetic sequence.

(ii) Find the sum of the sequence

(8 marks)

(c) Given the first term $T_1 = 1$ and the fifth term $T_5 = 81$.

(i) Insert three geometric terms between 1 and 81.

(ii) Find the sum of the first 5 terms.

(10 marks)

Q5 (a) Without using calculator, find the value of sin (30°+120°)

(5 marks)

(b) Verify the identity: $\cos^2\theta\ (1 + \tan^2\theta) = 1$

(4 marks)

(c) Solve $3\sin^2\theta = 1$ for $0^\circ \le \theta \le 360^\circ$.

(6 marks)

(d) Given $4\sin\theta + 3\cos\theta = r\sin(\theta + \alpha)$ and $0 \le \theta \le 2\pi$.

(i) Find r and α.

(ii) Thus find the values of θ if $4\sin\theta + 3\cos\theta = 2$.

(10 marks)

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SEMESTER / SESSION : SEM 1 / 2012/2013 PROGRAMME: 1 DAB/ DAJ/ DAR

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Formulae

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

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

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

ii) $S_n = \dfrac{a(1-r^n)}{1-r}$ if $r < 1$

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

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

Trigonometry Equation in the Form: *a* sin θ + *b* cos θ = *c*

Let $a\sin\theta + b\cos\theta = r\sin(\theta+\alpha)$

$= r(\sin\theta\cos\alpha + \cos\theta\sin\alpha)$

$= (r\cos\alpha)\sin\theta + (r\sin\alpha)\cos\theta$

We get $a = r\cos\alpha$ and $b = r\sin\alpha$ $\Rightarrow r = \sqrt{a^2+b^2}$ $\quad \alpha = \tan^{-1}\left(\dfrac{b}{a}\right)$

We use the above to solve:

$a\sin\theta + b\cos\theta = r\sin(\theta+\alpha)$

$a\sin\theta - b\cos\theta = r\sin(\theta-\alpha)$

$a\cos\theta + b\sin\theta = r\cos(\theta-\alpha)$

$a\cos\theta - b\sin\theta = r\cos(\theta+\alpha)$

Matrices

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

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

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