Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER I
SESSION 2013/2014

COURSE NAME	:	TECHNICAL MATHEMATICS I
COURSE CODE	:	DAS 11003
PROGRAMME	:	1 DAB /1 DAJ /1 DAR / 1 DAK
EXAMINATION DATE	:	DECEMBER 2013/JANUARY 2014
DURATION	:	3 HOURS
INSTRUCTION	:	ANSWER ALL QUESTIONS IN **PART A** AND **THREE (3)** QUESTIONS IN **PART B**

THIS QUESTION PAPER CONSISTS OF **EIGHT (8)** PAGES

PART A

Q1 (a) Convert the following degrees measures into radian

(i) $80°$

(2 marks)

(ii) $-336°$

(2 marks)

(b) Convert the following measures into degrees

(i) $168°16'$

(2 marks)

(ii) $89°12'10''$

(3 marks)

(c) Find the reference angle, β for the following measures

(i) $\frac{\pi}{4}$ rad

(2 marks)

(ii) $\frac{2}{3}\pi$ rad

(2 marks)

(iii) 225^{o}

(2 marks)

(iv) -60^{o}

(2 marks)

(d) Solve $\cos\theta = -\frac{1}{\sqrt{2}}$ for $0 \leq \theta \leq 360°$

(3 marks)

Q2 (a) Given $A = \begin{pmatrix} 2 & -1 \\ 0 & 4 \end{pmatrix}$ $B = \begin{pmatrix} 1 & 0 \\ 3 & -2 \\ 5 & 6 \end{pmatrix}$ $C = \begin{pmatrix} 3 \\ -4 \\ 7 \end{pmatrix}$

$D = \begin{pmatrix} 4 & 1 & -2 \\ 3 & 5 & 9 \\ -1 & 7 & 8 \end{pmatrix}$ $E = \begin{pmatrix} 5 & 10 \\ 4 & -8 \end{pmatrix}$ $F = \begin{pmatrix} 3 & 6 \\ 4 & 5 \\ 2 & -7 \end{pmatrix}$

Calculate the following

(i) $2A + \frac{1}{2}E$

(2 marks)

(ii) $4B - F$

(2 marks)

(iii) DC

(2 marks)

(iv) $FA + B$

(2 marks)

(b) Given a system of linear equation:

$$\begin{aligned} x + y + z &= 6 \\ 2x - y + z &= 6 \\ 3x + 2y - 3z &= -1 \end{aligned}$$

(i) Write into matrix equation, AX = B.

(2 marks)

(ii) Write the augmented matrix, [A|B].

(1 marks)

(iii) By using Gauss-Jordan elimination method, find the matrix X starting with the following row-operations:
$R_2 - 2R_1, R_3 - 3R_1$, ...

(9 marks)

PART B

Q3 (a) Simplify

(i) $\dfrac{12x^2-31x+9}{(3x-1)^4}$

(3 marks)

(ii) $2+\dfrac{x-1}{(x+4)^2}$

(3 marks)

(iii) $(2xy^2z^4)^4(3x^{-1}z^2)^3(xy^5z^4)$

(5 marks)

(b) Simplify

(i) $5\sqrt{\dfrac{4}{75}}$

(4 marks)

(ii) $\dfrac{2+\sqrt{5}}{4-\sqrt{5}}$

(5 marks)

Q4 (a) Express $\dfrac{x+2}{x^3-6x^2-7x}$ into partial fraction.

(9 marks)

(b) Given $f(x)=x^2-2x-1$. If $f(x)=0$, by using Bisection method, find its root, x, between interval [2, 3]. Iterate until $|f(x)|<\varepsilon=0.005$. Give your answer to three decimal point.

(11 marks)

Q5 (a) A theater has 60 seats in the first row, 68 seats in the second row, 76 seats in the third row, and so on, in the same increasing pattern. If the theater has 20 rows of seats, find the number of seats in the theater?

(5 marks)

(b) The sum of the first two terms of a geometric progression (S_2) is 36 and the product of the first term (T_1) and third term (T_3) is 9 times the second term (T_2). Find the sum of the first 8 terms.

(7 marks)

(c) Write the first four terms for binomial series $\frac{1}{(1+x^3)^4}$. Simplify the answers.

(8 marks)

Q6 (a) Prove that $\sec\theta - \sin\theta\tan\theta = \cos\theta$.

(4 marks)

(b) (i) By using the half-angle formula, find the value of $\sin 22.5^\circ$ without using calculator.

(5 marks)

(ii) By using the double-angle formula and without using calculator, find the value of $\sin 240^\circ - \cos 120^\circ$.

(5 marks)

(c) Given $5\sin\theta + 12\cos\theta = r\sin(\theta + \alpha)$ and $0 \le \theta \le 2\pi$.

(i) Find r and θ.

(2 marks)

(ii) Find the values of θ if $5\sin\theta + 12\cos\theta = 15$.

(4 marks)

Q7 (a) Let $\log_b 2 = 0.3869$, $\log_b 3 = 0.6131$, and $\log_b 5 = 0.8982$. By using these values, evaluate $\log_b 9 + \log_b 10$.

(5 marks)

(b) Solve the given quadratic equations:

(i) $3x^2 - x - 2 = 0$ by factorizing.

(3 marks)

(ii) $3x^2 - 12x - 7 = 0$ by completing the square.

(6 marks)

(c) Solve $\dfrac{(x+1)(1-2x)}{(x-2)} \leq 0$.

(6 marks)

- END OF QUESTION –

FINAL EXAMINATION

SEMESTER/SESSION : SEM 1 / 2013/2014 PROGRAMME: 1 DAB/1 DAJ/1 DAR/1 DAK

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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 $r > 1$

Binomial Coefficient

$$\binom{n}{r} = \frac{n!}{r!\,(n-1)!}$$

Binomial Coefficient for Negative and Radical Indices

$$\binom{r}{n} = \frac{r(r-1)(r-2)\ldots(r-n+1)}{1.2.3\ldots\ldots n}$$

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

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

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

$$A^{-1} = \frac{1}{|A|}Adj(A) \qquad Adj\ (A) = (c_{ij})^T$$