Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER I
SESSION 2018/2019

COURSE NAME	:	TECHNICAL MATHEMATICS I
COURSE CODE	:	DAS 11003
PROGRAMME CODE	:	DAK
EXAMINATION DATE	:	DECEMBER 2018 / JANUARY 2019
DURATION	:	3 HOURS
INSTRUCTION	:	ANSWER **ALL** QUESTIONS IN **SECTION A** AND **FOUR (4)** QUESTIONS IN **SECTION B**

THIS QUESTION PAPER CONSISTS OF **SEVEN (7)** PAGES

SECTION A

Q1 (a) Given matrix $A = \begin{bmatrix} -4 & 2 & 0 \\ 10 & -6 & 14 \\ -2 & 12 & -10 \end{bmatrix}$, find the cofactor of the given entry.

(i) a_{13}

(ii) a_{23}

(iii) a_{31}

(6 marks)

(b) Given

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

(i) Write the matrix equation AX = B of the system equation.

(1 marks)

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

(1 marks)

(iii) Find the determinant of matrix A.

(2 marks)

(iv) Solve the above system for x, y and z by using Gauss-Jordan elimination method. Do this following operation in order:

$R_1 \leftrightarrow R_2$, $R_2 - 3R_1$, $R_3 - 2R_1$, $R_3 \leftrightarrow R_2$, $\frac{1}{5}R_3$, $R_1 + R_2$, $R_3 - 5R_2$, $-\frac{1}{2}R_3$, $R_1 - R_3$, $R_2 + R_3$.

(10 marks)

SECTION B

Q2 (a) Simplify the expressions below.

(i) $\dfrac{s^{3r}-t^{3r}}{s^{r}-t^{r}}$

(2 marks)

(ii) $\dfrac{1}{1+m^{p-q}}+\dfrac{1}{1+m^{q-p}}$

(4 marks)

(b) (i) Simplify $\dfrac{(x^3y)^4(-xy)^3}{(x^4y^2)^3}$

(3 marks)

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

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

(4 marks)

(c) Solve the following equations.

(i) $2\log_3 2x-\log_3(18x-32)=\log_3 2+\log_3 2$

(4 marks)

(ii) $3^{3n-1}=9^{n+\frac{1}{2}}$

(3 marks)

Q3 (a) Find the root of the $f(x)=x^2-5x+\sin 3x$ in the interval $[4,5]$ using Bisection method. Iterate until $|f(x_i)|<\varepsilon=0.005$. Show your calculation in four decimal places.

(10 marks)

(b) Express $\dfrac{2x^3-7x+1}{x^2-x-2}$ in the form of partial fraction.

(10 marks)

Q4 (a) Find the sum of $\sum_{k=1}^{17}\left(\frac{k^3}{2}-3k^2+k\right)$.

(5 marks)

(b) 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 20th terms of the sequence.

(7 marks)

(c) (i) Determine the number of terms in the Geometric Sequence 4, 3.6, 3.24, . . needed so that the sum exceeds 35.

(4 marks)

(ii) The sum to infinity of a Geometric Sequence is twice the sum of the first two terms. Find possible values of the common ratio.

(4 marks)

Q5 (a) (i) Prove the identity $\frac{\sin\theta}{1-\cos\theta}-\cot\theta=\frac{1}{\sin\theta}$.

(5 marks)

(ii) Solve the trigonometric equation

$$9\tan\theta+\tan^2\theta=5\sec^2\theta-3;\quad 0°\leq\theta\leq 360°.$$

(6 marks)

(b) If $\cos\theta=\frac{2}{3}$ and θ in the first quadrant. Evaluate $\tan\frac{\theta}{2}$.

(5 marks)

(c) Solve in between 0 and π for $\sin 2A = 0.5$.

(4 marks)

Q6 (a) Solve the inequality $\frac{(x-4)(5-x)}{(x+2)} \geq 0$.

(6 marks)

(b) Determine which of the following irrational numbers is greater: $\sqrt{10}$ or $\sqrt[3]{22}$.

(4 marks)

(c) Show that if $2\sin\theta - 5\cos\theta = R\sin(\theta - \alpha)$, then $R = \sqrt{29}$ and $\tan\alpha = \frac{5}{2}$.

Find the values of θ if $2\sin\theta - 5\cos\theta = 4$ for $0° \leq \theta \leq 360°$.

(10 marks)

– END OF QUESTIONS –

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FORMULA

Polynomials

$$\log_a x = \frac{\log_a x}{\log_a b} \qquad a^3 - b^3 = (a-b)(a^2+ab+b^2) \qquad a^3 + b^3 = (a+b)(a^2-ab+b^2)$$

$$x = \frac{-b \pm \sqrt{b^2-4ac}}{2a}, \qquad x^2+bx+c = \left(x+\frac{b}{2}\right)^2 - \left(\frac{b}{2}\right)^2 + c, \qquad x_{i+2} = \frac{x_i f(x_{i+1}) - x_{i+1} f(x_i)}{f(x_{i+1}) - f(x_i)}$$

Sequence and Series

$$\sum_{k=1}^{n} c = cn, \quad \sum_{k=1}^{n} k = \frac{n(n+1)}{2}, \quad \sum_{k=1}^{n} k^2 = \frac{n(n+1)(2n+1)}{6}, \quad \sum_{k=1}^{n} k^3 = \left(\frac{n(n+1)}{2}\right)^2$$

$$u_n = a + (n-1)d \qquad S_n = \frac{n}{2}[2a+(n-1)d], \qquad S_n = \frac{n}{2}(a+u_n)$$

$$u_n = ar^{n-1}, \quad S_n = \frac{a(r^n-1)}{r-1}, r>1 \ \textbf{OR} \ S_n = \frac{a(1-r^n)}{1-r}, r<1, \quad S_\infty = \frac{a}{1-r}.$$

$$u_n = S_n - S_{n-1}$$

$$(1+b)^n = 1 + nb + \frac{n(n-1)}{2!}b^2 + \frac{n(n-1)(n-2)}{3!}b^3 + \ldots\ldots$$

Trigonometry

$$\sin^2 x + \cos^2 x = 1, \quad \tan^2 x + 1 = \sec^2 x, \quad 1 + \cot^2 x = \csc^2 x$$

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

$$\tan(\alpha \pm \beta) = \frac{\tan\alpha \pm \tan\beta}{1 \mp \tan\alpha\tan\beta} \qquad \tan 2\theta = \frac{2\tan\theta}{1 - \tan^2\theta}$$

$$\sin 2\theta = 2\sin\theta\cos\theta, \quad \cos 2\theta = \cos^2\theta - \sin^2\theta = 2\cos^2\theta - 1 = 1 - 2\sin^2\theta$$

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$$\sin\frac{\theta}{2}=\pm\sqrt{\frac{1-\cos\theta}{2}}\ ,\quad \cos\frac{\theta}{2}=\pm\sqrt{\frac{1+\cos\theta}{2}}\ ,\quad \tan\frac{\theta}{2}=\pm\sqrt{\frac{1-\cos\theta}{1+\cos\theta}}$$

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

$a=r\cos\alpha$ and $b=r\sin\alpha$

$$x_1^{(k+1)}=\frac{b_1-a_{12}x_2^{(k)}-a_{13}x_3^{(k)}}{a_{11}}\ ,\quad x_2^{(k+1)}=\frac{b_2-a_{21}x_1^{(k+1)}-a_{23}x_3^{(k)}}{a_{22}}\ ,\quad x_3^{(k+1)}=\frac{b_3-a_{31}x_1^{(k+1)}-a_{32}x_2^{(k+1)}}{a_{33}}$$

Matrices

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