



WEST BENGAL STATE UNIVERSITY

B.Sc. Programme 6th Semester Examination, 2022

MTMGDSE03T-MATHEMATICS (DSE2)

NUMERICAL METHODS

Time Allotted: 2 Hours

Full Marks: 50

The figures in the margin indicate full marks.

Candidates should answer in their own words and adhere to the word limit as practicable.

All symbols are of usual significance.

Answer Question No. 1 and any *five* from the rest

1. Answer any *five* questions from the following: 2×5 = 10

- (a) Write down the relations of Central difference operator, δ and Average operator, μ with the shift operator E .
- (b) Obtain two consecutive integers between which there is a root of $x^3 + x + 5 = 0$.
- (c) Write down the number $\frac{2}{3}$ correct upto 5 significant figures and find relative error.
- (d) Why is the Newton-Raphson method for computing a simple root of an equation $f(x) = 0$ called method of tangents?
- (e) Construct a linear interpolation for $f(x)$ with $f(1) = 3$ and $f(2) = -5$.
- (f) Show that $\Delta \log f(x) = \log[1 + \Delta f(x)/f(x)]$
- (g) Find the value of $f'(0.2)$ using the table of values of $f(x)$

x	0.2	0.4	0.6
$f(x)$	1.6596	1.6698	1.6804

- (h) Using trapezoidal rule compute $\int_0^2 f(x) dx$. Given

x	0	1	2
$f(x)$	1.6	3.8	8.2

2. (a) Find a real root of the equation $3x - \cos x - 1 = 0$ correct to two significant figures by using Newton Raphson method. 4
- (b) Discuss method of bisection for computing a real root of an equation $f(x) = 0$. 4
3. (a) Find Lagrange's interpolation polynomial for the function $f(x) = \sin \pi x$, when $x_0 = 0$, $x_1 = \frac{1}{6}$, $x_2 = \frac{1}{2}$. Also compute the value of $\sin \frac{\pi}{3}$ and estimate the error. 3+1+1
- (b) Find $f(5)$, given that $f(0) = -2$, $f(1) = 4$, $f(2) = 6$, $f(3) = 10$ and third difference being constant. 3

4. (a) Solve the equation 6
- $$\begin{aligned} 2x + 3y + z &= 9 \\ x + 2y + 3z &= 6 \\ 3x + y + 2z &= 8 \end{aligned}$$
- by the method of matrix factorization
- (b) Round off the number 40.3586 and 0.0056812 to four significant digits. 2
5. (a) Find the missing terms in the following table: 4
- | | | | | | | |
|-----|---|---|---|-----|---|-----|
| x | 0 | 1 | 2 | 3 | 4 | 5 |
| y | 1 | 5 | — | 121 | — | 781 |
- (b) Use of Stirling interpolation formula prove that 4
- $$\frac{d}{dx} f(x) = \frac{2}{3} [f(x+1) - f(x-1)] - \frac{1}{12} [f(x+2) - f(x-2)],$$
- considering the differences upto third order.
6. (a) Compute $f(0.5)$ from the following table 4
- | | | | | |
|--------|---|---|----|----|
| x | 0 | 1 | 2 | 3 |
| $f(x)$ | 1 | 2 | 11 | 34 |
- (b) Show that n th order difference of a polynomial of degree n are constant. Does the converse of the result true? 4
7. (a) Evaluate numerically the integration $\int_0^1 \frac{1}{1+x} dx$, by Simpson's $\frac{1}{3}$ rd rule taking 6 equal subintervals. 4
- (b) If $f(x)$ is a polynomial of degree 2, prove that 4
- $$\int_0^1 f(x) dx = [5f(0) + 8f(1) - f(2)] / 12.$$
8. (a) Compute by the method of fixed point iteration method the positive root of the equation $x^2 - x - 0.1 = 0$ correct upto three significant figures. 4
- (b) Find the real root of the equation $x^3 - x - 1 = 0$ by Regula-Falsi method correct upto two significant figures. 4
9. (a) Use Euler's method with $h = 0.2$ to find the solution of $\frac{dy}{dx} = 2x + y$, $y(0) = 1$ at $x = 0.4$. 5
- (b) Find the location of the positive roots of $x^3 - 9x + 1 = 0$, and evaluate the smallest one by bisection method correct to two decimal places. 3

N.B. : Students have to complete submission of their Answer Scripts through E-mail / Whatsapp to their own respective colleges on the same day / date of examination within 1 hour after end of exam. University / College authorities will not be held responsible for wrong submission (at in proper address). Students are strongly advised not to submit multiple copies of the same answer script.

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