



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 4
equal subintervals.
- (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 4
equation $x^2 - x - 0.1 = 0$ correct upto three significant figures.
- (b) Find the real root of the equation $x^3 - x - 1 = 0$ by Regula-Falsi method correct 4
upto two significant figures.
9. (a) Use Euler's method with $h = 0.2$ to find the solution of $\frac{dy}{dx} = 2x + y$, $y(0) = 1$ at 5
 $x = 0.4$.
- (b) Find the location of the positive roots of $x^3 - 9x + 1 = 0$, and evaluate the smallest 3
one by bisection method correct to two decimal places.

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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