



**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,  $\delta$  and Average operator,  $\mu$  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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