

**TDC Odd Semester Exam., 2020
held in July, 2021**

MATHEMATICS

(Honours)

(5th Semester)

Course No. : MTMH-501

(Numerical Analysis)

Full Marks : 35

Pass Marks : 12

Time : 2 hours

*The figures in the margin indicate full marks
for the questions*

Answer **five** questions, taking **one** from each Unit

UNIT—I

1. (a) What do you mean by interpolation? Which interpolation formula is most applicable for interpolating the value near the end of a set of tabulated values? 2

- (b) Define the divided differences of order n for a function $f(x)$. Prove that for equally spaced interpolating points

$$x_0, x_1, x_2, \dots, x_n$$

where

$$x_r = x_0 + rh \quad (r = 1, 2, \dots, n)$$

for some $h > 0$

$$f(x_0, x_1, x_2, \dots, x_n) = \frac{\Delta^n f(x_0)}{n! h^n} \quad 5$$

2. (a) How many digits are to be taken in computing $\sqrt{20}$, so that the error does not exceed 0.1%? 2
- (b) Explain the principle of propagation of errors and explain how it effects numerical computation. 5

UNIT—II

3. (a) Establish Newton's forward interpolation formula. 4
- (b) The following table gives values of $f(x)$ corresponding to those of x :

x	: 0	1	2	3	4
$f(x)$: 3	6	11	18	27

Find the form of the function $f(x)$. 3

(3)

4. Find $f(21)$ and $f(38)$ from the following table : 7

x :	20	25	30	35	40
$f(x)$:	57.61	51.35	48.15	44.32	40.62

UNIT—III

5. (a) State Stirling's and Bessel's interpolation formula, when are they used? 3

(b) The values of x and $f(x)$ are given in the following table :

x :	25	30	35	40	45
$f(x)$:	1.39794	1.47712	1.54407	1.60206	1.65321

Calculate the value of $f(37)$ using Gauss forward difference formula. 4

6. Compute $f(\theta)$ for $\theta = 15^\circ$, from the following table : 7

θ :	10°	12°	14°
$f(\theta)$:	0.176327	0.212556	0.249328

θ :	16°	18°	20°
$f(\theta)$:	0.286745	0.324920	0.363970

using (a) Stirling's formula and (b) Bessel's formula.

(4)

UNIT—IV

7. (a) Explain the method of bisection for computing a simple real root of an equation $f(x) = 0$ and discuss the convergence of this iterative process. 5

(b) Write the advantage and disadvantage of Regula-falsi method. 2

8. (a) Compute a root of $x \log x = 1$ by Regula-falsi method, correct to three-decimal places. 3

(b) Use the functional iteration method to find a root of the equation $x^3 + 3x - 1 = 0$ 4

UNIT—V

9. (a) Obtain Simpson's one-third rule for numerical integration and give the geometrical significance of it. 5

(b) Find $\frac{dy}{dx}$ at $x = 1.2$ from the following table : 2

x :	1	2	3	4	5	6
y :	1.987	2.954	3.894	4.794	5.646	6.442

(5)

10. (a) Calculate the value of

$$\int_0^1 \frac{x}{1+x} dx$$

correct up to three significant figures
taking six intervals by Simpson's
one-third rule.

4

(b) Using trapezoidal rule, evaluate

$$\int_0^1 \cos x dx$$

correct up to 3-significant figures by
taking five equal sub-intervals.

3

★ ★ ★