Course Title: Numerical Computations **Course Code: MTG 102**

Total marks: 60 **Date: 27/04/2023 Duration: 2hrs** **Total No of pages:2**

Instructions: *1. All questions are compulsory however internal choice is available.*
2. Figures to the right indicate marks allotted to each question/ subquestion.
3. Use of non-programmable calculator is allowed.

Q. 1. Answer any five of the following. (2X5=10)

a. Construct a difference table for the data given below.

X	10	20	30	40
Y	1	2	4	7

b. Evaluate the sum $S=\sqrt{2}+2$ to 4 significant digits and find the relative error.

c. Explain the term round-off error. Round off the following numbers to four significant figures.
i)2.00845 ii)0.001359339

d. Prove that $\Delta = E - 1$, where Δ is a forward difference operator and E is the shift operator.

e. If y(1)=4, y(3)=12, y(4)=19 and y(7)=x. Find x using Lagrange's formula.

f. Explain the following terms: i) percentage error ii) Absolute error.

g. The number $\frac{1}{3}$ is approximated as 0.33 and 0.34. Which among the two approximations is more accurate.

Q. 2. **Answer any five of the following.** (2X5=10)

a. The table given below gives the temperature as a function of time, f(t)

t	1	2	3	4	5
f(t)	11	15	18	23	28

Find $\int_1^5 f(t)\,dt$ using trapezoidal rule.

b. Explain the bijection method for finding the real root of the equation $f(x) = 0$, write an algorithm for its implementation.

c. Write the normal equations to find the straight-line equation to given set of data by method of least square.

d. Given the equation $x^{2.2} = 69$ has a root between 6 and 7. Use the Regula-Falsi method to determine the root correct to 2 significant figures.

e. Write the procedure to fit the exponential curve $y = ab^x$ to given set of data by method of least square

f. State Newton's Backward interpolation formula with assumptions.

g. Find $\nabla^2 y_5$ from the data given below.

X	2	4	6	8	10
Y	2	5	10	17	26

Q.3. Answer the following questions.

A. Prove that $(1+\Delta)(1-\nabla) = 1$.

OR

A. The table below gives the values of the function f(x) for some equally spaced values of the argument x. Use Newton's formula for interpolation to find f(7.5).

x	1	2	3	4	5	6	7	8
f(x)	1	8	27	64	125	216	343	512

B. Given the values, evaluate f(9), using Newtons divided difference formula. (5)

X	5	7	11	13	17
f(X)	15	32	52	66	72

Q. 4. Answer the following questions.

A. Evaluate $\int_0^6 \frac{dx}{1+x^2}$ using Simpson's $3/8^{th}$ rule.

OR

A. Given that y(1.0)=7.989, y(1.1)=8.403, y(1.2)=8.781, y(1.3)=9.129, y(1.4)=9.451, y(1.5)=9.9750, y(1.6)=10.031. Find $\frac{dy}{dx}$ and $\frac{d^2y}{dx^2}$ at x=1.1

B. Evaluate $\int_0^{12} 1 + 3x\,dx$ by Weddle's rule. (5)

Q.5. Answer the following questions.

A. Fit a straight line to the following data regarding x as the independent variable using least squares method. (5)

x	0	1	2	3	4
y	1	1.8	3.3	4.5	6.3

OR

A. Fit a straight line $y = a + bx$ to the following data using least squares method.

x	1	2	3	4	5
y	5	7	9	10	11

(5)

B. Fit a parabolic curve to the following data using least squares method. (5)

x	0	1	2	3	4
y	1	1.8	1.3	2.5	6.3

Q.6. Answer the following questions.

A. Find a real root of $f(x) = x^3 - 2x - 5 = 0$ using Regula-Falsi Method correct to three decimal places. (5)

OR

A. Obtain the positive solution to $x^2 - 12 = 0$, to five places of decimal by the Newton Raphson method. (5)

B. Find a real root of $f(x) = x^2 - 5x + 2 = 0$ correct to three significant figures (5)