

GURU NANAK INSTITUTE OF TECHNOLOGY
An Autonomous Institute under MAKAUT
2021

NUMERICAL METHODS (Backlog)
M(CS)401

TIME ALLOTTED: 3HR

FULL MARKS:70

*The figures in the margin indicate full marks.**Candidates are required to give their answers in their own words as far as practicable***GROUP – A****(Multiple Choice Type Questions)**Answer any **ten** from the following, choosing the correct alternative of each question: **10×1=10**

- | | Marks | CO No. |
|--|-------|--------|
| 1. (i) Newton Raphson method fails when
(a) $f'(x)=1$
(b) $f'(x)=-1$
(c) $f'(x)=0$
(d) None of These | 1 | CO1 |
| (ii) Which of the following relation is false
(a) $\Delta - \nabla \equiv \Delta \nabla$
(b) $E^{-1} \equiv I - \nabla$
(c) $\Delta + \nabla \equiv \Delta / \nabla$
(d) None of These | 1 | CO1 |
| (iii) Bisection method fails when
(a) $f(a)f(b)=0$ (b) $f(a)f(b)<0$
(c) both (a) and (b) (d) None of These | 1 | CO2 |
| (iv) Gauss Seidel method is
(a) direct method
(b) indirect method
(c) iterative method
(d) None of These | 1 | CO1 |
| (v) Gauss Elimination method is
(a) direct method
(b) indirect method
(c) iterative method
(d) None of These | 1 | CO1 |
| In Trapezoidal rule of finding $\int_a^b f(x) dx$, $f(x)$ is approximated by
(a) linear segment
(vi) (b) parabola
(c) circular sector
(d) part of ellipse | 1 | CO1 |

- (vii) In Simpson's $1/3^{\text{rd}}$ rule of finding $\int_a^b f(x) dx$, $f(x)$ is approximated by
 (a) linear segment
 (b) parabola
 (c) circular sector
 (d) part of ellipse 1 CO1
- (viii) An other name of Regula- Falsi method is 1 CO1
 (a) Tangent method
 (b) Root method
 (c) Method of False position
 (d) None of These
- (ix) Round off to the 4 significant digits of the number 7.103531 1 CO2
 (a) 7.103
 (b) 7.104
 (c) 7.105
 (d) none of these
- (x) Degree of precession of Trapezoidal Rule of Integration is 1 CO1
 (a) 1
 (b) 2
 (c) 3
 (d) 4
- (xi) $\Delta\left(\frac{1}{x}\right)$ is equal to 1 CO2
 (a) $\frac{1}{x(x+h)}$
 (b) $\frac{1}{x+h}$
 (c) $-\frac{h}{x+h}$
 (d) $-\frac{h}{x(x+h)}$

GROUP – B

(Short Answer Type Questions)

Answer any **three** from the following: $3 \times 5 = 15$

- | | | | |
|----|---|--------------|---------------|
| | | Marks | CO No. |
| 2. | Find $f(1.02)$ by Newton's forward interpolation formula from the table | 5 | CO3 |

x	1.00	1.10	1.20	1.30
f(x)	0.8415	0.8912	0.9320	0.9636

3. Evaluate $\int_1^3 \frac{x dx}{x^2 + 3}$ by Simpson's 1/3 rule, taking 6 equal subintervals 5 CO2
4. Solve the differential equation by Euler method $\frac{dy}{dx} = (1 - y)$, $y(0) = 0$ at $x=0.1, 0.2$. 5 CO3
5. Write down the approximate representation of $\pi (= \frac{22}{7})$ correct to four significant figures and the find absolute error, relative error, relative percentage error. 5 CO2
6. Using the following table, find $f(3.5)$ correct upto two decimal places.. 5 CO3

x	0	1	2	3	4
f(x)	41	43	47	53	61

GROUP – C
(Long Answer Type Questions)
 Answer any **three** from the following: **3×15=45**

- | | | Marks | CO No. |
|--|--|--------------|---------------|
|--|--|--------------|---------------|
7. a) From the following table, find by Lagrange's formula, the value of y when x=102. 8 CO2
- | | | | | | |
|---|-------|-------|-------|-------|-------|
| x | 93.0 | 96.2 | 100.0 | 104.2 | 108.7 |
| y | 11.38 | 12.80 | 14.70 | 17.07 | 19.91 |
- b) Compute one root of $\sin x = 10(x - 1)$, correct to two decimal places by Regula Falsi method. 7 CO2
- 8.a) For finding the square root of 'a' ($a > 0$), derive the Newton Raphson iteration formula $x_{n+1} = \frac{1}{2}(x_n + \frac{a}{x_n})$, $n = 0, 1, 2, 3, \dots$ 7 CO3
- Hence find $\sqrt{2}$, correct to five significant figures.
- b) Solve by Euler's modified method the following differential equation for $x=0.02$ taking step length $h=0.01$, $\frac{dy}{dx} = x^2 + y$, $y=1$ when $x=0$. 8 CO3
- 9.a) Compute $y(0.4)$ by Runge Kutta method of fourth order for the differential equation $\frac{dy}{dx} = xy + y^2$, $y(0) = 1$, taking $h=0.1$ 8 CO2
- b) Estimate the value of $f(1.5)$ & $f(7.5)$ using Newton's forward & backward interpolation formula respectively from the following data: 7 CO3

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

- 10.a) Apply Newton's divided formula to compute the value of y for $x=0.72$, from the following table correct to six decimal places. 7 CO3

x	0.62	0.68	0.70	0.73	0.75
y=f(x)	0.6604918	0.7336304	0.7585837	0.7965858	0.8223167

- b) Solve the system of equations by Gauss Seidel method: 8 CO3
- $$10x - 5y - 2z = 3$$
- $$4x - 10y + 3z = -3$$
- $$x + 6y + 10z = -3$$

Correct to four significant figures.

- 11.a) Solve the system of equations by Gauss Elimination method: 5 CO2
- $$3x_1 + 9x_2 - 2x_3 = 11$$
- $$4x_1 + 2x_2 + 13x_3 = 24$$
- $$4x_1 - 2x_2 + x_3 = -8$$

Correct to four significant figures.

- b) Compute one positive root of $x + \ln x - 2 = 0$, correct to four decimal places by method of Newton Raphson. 5 CO2

- c) Compute $y(1.3)$ by Runge Kutta method of fourth order for the differential equation $\frac{dy}{dx} = xy$, $y(1) = 1$, taking $h=0.1$ 5 CO2