GURU NANAK INSTITUTE OF TECHNOLOGY
An Autonomous Institute under MAKAUT
2021
NUMERICALMETHODS (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)	In Simpson's 1/3 rule, the portion of curve is replaced by (a) Straight line (b) Circular path (c) Parabolic path (d) none of these.	1	CO1
	(ii)	Which of the following true? (a) $\Delta^n x^n = (n+1)!$ (b) $\Delta^n x^n = n!$ (c) $\Delta^n x^n = 0$ (d) $\Delta^n x^n = n$.	1	CO2
	(iii)	Number of significant digits of 0.00001234 (a) 9 (b) 4 (c) 8 (d) none of these .	1	CO2
	(iv)	In trapezoidal rule of finding $\int_a^b f(x)\,dx$, the function $f(x)$ is approximated by (a) linear segment (b) parabola (c) circular sector (d) part of ellipse	1	CO1

(v)	If $f(x)=\frac{1}{x^2}$, then divided difference $f(a,b)$is (a) $\frac{(a+b)}{(ab)^2}$ (b) $-\frac{(a+b)}{(ab)^2}$ (c) $\frac{1}{a^2+b^2}$ (d) $\frac{1}{a^2}-\frac{1}{b^2}$	1	CO3
(vi)	Newton-Raphson method fails when (a) $f'(x)=1$ (b) $f'(x)=0$ (c) $f'(x)=-1$ (d) $f''(x)=0$.	1	CO1
(vii)	Which of the following is not true (the notations have their usual meanings) ? (a) $\Delta \equiv E-I$ (b) $\frac{\Delta}{\nabla}\equiv\Delta+\nabla$ (c) $\Delta\nabla\equiv\Delta-\nabla$ (d) $\nabla\equiv I-E^{-1}$	1	CO3
(viii)	In Gauss-elimination method, the given system of equation by $AX = B$ is converted to another system UX=y, where U is (a) diagonal matrix (b) null matrix (c) identity matrix (d) upper triangular matrix.	1	CO1
(ix)	Lagrange's interpolation formula deals with arguments which are (a) Equispaced (b) Unequispaced (c) Both (a) and (b) (d) None of these.	1	CO1
(x)	The percentage error in approximation $\frac{4}{3}$ to 1.3333 is (a) 0.0025% (b) 25% (c) 0.000025% (d) 0.25%	1	CO2

(xi) $\Delta^2(y_1)$ may be expressed as which of the following terms? 1 CO3

(a) $(y_3 - 3y_2 + 3y_1 - y_0)$

(b) $(y_2 - 2y_1 + y_0)$

(c) $(y_3 - 3y_2 + 3y_1 + y_0)$

(d) None of these

(xii) Runge-kutta method has a truncation error, which is of the order of 1 CO2

(a) h^2

(b) h^4

(c) h^5

(d) none of these.

GROUP – B

(Short Answer Type Questions)

(Answer any *three* of the following) **3 x 5 = 15**

		Marks	CO No.
2.	Evaluate $\int_1^3 \frac{xdx}{x^2+3}$ by trapezoidal rule of integration, taking 6 equal subintervals and hence find the value of $\log_e \sqrt{3}$ correct to 4 decimal places.	5	CO3
3.	Solve by Euler's method the following differential quation for x=0.02 taking step length h=0.01, $\frac{dy}{dx} = x^2 + y$, y=1 when x=0 correct to 5 decimal places	5	CO3
4.	Construct Newton-Raphson's iteration formula for finding $\sqrt{27}$ Hence find $\sqrt{27}$ correct to 4 decimal places.	5	CO2
5.	Find the absolute, relative and relative percentage error in computation of $f(x) = 3\sin(x) - 2x^2 - 9$ for $x = 0$, if the error in x is 0.003	5	CO1
6.	Using Crank-Nicholson's method, solve $U_{xx} = 16\, u_t$, $0 < x < 1, t > 0$, given $U(x,0) = 0$, $u(0,t) = 0$, $u(1,t) = 100t$ Compute 'u' for one step in 't' direction taking h = ¼	5	CO2

GROUP – C
(Long Answer Type Questions)

(Answer any *three* of the following) **3 x 15 = 45**

		Marks	CO No.
7. a)	Solve the system of equations by LU factorization method: $x_1 + x_2 - x_3 = 2$ $2x_1 + 3x_2 + 5x_3 = -3$. $3x_1 + 2x_2 - 3x_3 = 6$	9	CO2
b)	Find the value of $\sqrt{2}$ correct up to 4 decimal places from the following table:	6	CO3

x:	1.9	2.1	2.3	2.5	2.7
$\sqrt{x}$:	1.3784	1.4491	1.5166	1.5811	1.6432

8. a)	Find y(1.315) from the following table						8	CO3

x:	1.0	1.1	1.2	1.3	1.4	1.5	1.6
y:	1.5431	1.6685	1.8107	1.9709	2.1509	2.3524	2.5775

By using Stirling's formula correct to four decimal places.

b)	Compute $y(0.2)$ by Runge Kutta method of fourth order with $h = 0.1$ for the differential equation $\frac{dy}{dx} + y = x^2$ with $y(0) = 1$.	7	CO3
9. a)	Compute one root of $3x - \cos x - 1 = 0$, correct to two decimal places by Regula Falsi method.	6	CO2
b)	Solve the system of linear equations by Gauss-Seidel method: $10x + y - z = 12$ $2x + 10y - z = 1$ $2x + 2y - 10z = 14$ correct to two decimal places.	9	CO3
10.a)	Solve by Euler's modified method the following differential equationfor x=0.02 taking step length h=0.02, $\frac{dy}{dx} = x^2 + y$, y=1 when x=0,correct upto 3 decimal places.	7	CO3
b)	Compute y(0.4) by Milne's Predictor Corrector method from the equation $\frac{dy}{dx} = xy + y^2$,correct upto 3 decimal places.Giventhat y(0)=1,y(0.1)=1.1169,y(90.2)1.2773,y(90.30)=1.5040.	8	CO2
11(a)	Find the solution of the System of linear equations Ax=b where $A = \begin{pmatrix} 4 & -2 & 1 \\ -1 & 5 & -2 \\ 1 & 1 & 3 \end{pmatrix}$, $b = \begin{pmatrix} 2 \\ 4 \\ 6 \end{pmatrix}$ by using Successive Over Relaxation (SOR) method, with value w = .5 (Relaxation parameter) and initial point $x^{(0)} = (1 \quad 2 \quad 1)^T$.	7	CO2

b)	Compute the following integration $\int_0^1 \frac{1}{1+x^2} dx$, by Romberg method taking length of intervals 1, 0.5, 0.25, 0.125 correct upto five decimal places	8	CO3