Total No. of printed pages = 3

MA 131401 NR

29/7/22

Roll No. of candidate

2022

B.Tech. 4th Semester End-Term Examination

NUMERICAL METHODS AND COMPUTATION

(New Regulations)

Full Marks – 70 Time – Three hours

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

Answer Question No. 1 and any *Four* from the rest.

1. Choose the correct answer from the following : $(10 \times 1 = 10)$

(i) Round off to the four significant digits of the number 8.203524 is _____.

(a) 8.203 (b) 8.204

(c) 8.2035 (d) none of these

(ii) Which of the following is a true relation?

(a) $\Delta = 1 - E$ (b) $\nabla = 1 - E^{-1}$

(c) $\Delta\nabla = \Delta - \nabla$ (d) none of these

(iii) If $x = 5$, what is Δx ?

(a) 0 (b) 1

(c) 3 (d) 4

(iv) If $y = ax^3$, then for $h = 1$, $\Delta^2 y$ is

(a) 0 (b) $6a$

(c) $6ax$ (d) a

(v) The error in composite Trapezoidal rule with n interval is

(a) $-\frac{h^2}{12}(b-a)f''(x)$ (b) $-\frac{h^3}{12}(b-a)f''(x)$

(c) $-\frac{h^4}{180}(b-a)f^{iv}(x)$ (d) none of these

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(vi) In Simpson's $\frac{1}{3}$ rule the curve $y = f(x)$ is approximated as

(a) straight line (b) second degree curve

(c) third degree curve (d) fourth degree curve

(vii) Newton-Raphson method is given by

(a) $x_{n+1} = x_n - \frac{f(x_n)}{f'(x_n)}$ (b) $x_{n+1} = x_n + \frac{f(x_n)}{f'(x_n)}$

(c) $x_{n+1} = \frac{x_n f(x_{n-1}) - x_{n-1} f(x_n)}{f(x_n) - f(x_{n-1})}$ (d) none of these

(viii) Gauss elimination method is

(a) an iterative method (b) non-iterative method

(c) a diagonal method (d) matrix inversion method

(ix) If $f(a)f(b) < 0$ in bisection method after n interation, the root lies in the interal whose length is

(a) $\frac{b-a}{2}$ (b) $\frac{b-a}{2^n}$

(c) $\frac{(b-a)^n}{2}$ (d) $\left(\frac{b-a}{2}\right)^n$

(x) Error in modified Euler's method is

(a) $O(h^2)$ (b) $O(h^3)$

(c) $O(h^4)$ (d) $O(h^5)$

2. (a) Round the numbers to four significant figures : 2.30456, 23.40056, 3.42635, 0.0022718. (4)

(b) Prove that $\Delta^n y_r = \nabla^n y_{r+n}$ (5)

(c) Find the missing term from the following data: (6)

x:	1	2	3	4	5
y :	–1	3	-	53	111

3. (a) Prove that $\Delta^3(1-x)(1-2x)(1-3x) = -36, (h=1)$. (4)

(b) The time period of a simple pendulum is given by $T = 2\pi\sqrt{\frac{l}{g}}$. If l is increased by 2% and g is increased by 2% find the percentage change in T. (5)

(c) Find $f(2)$ for the curve $y = f(x)$ that takes values $f(0) = 3$, $f(3) = 18$, $f(6) = 195$, $f(9) = 896$. (6)

4. (a) Find the Lagrange's formula, the interpolation polynomial which corresponds to the following data: (7)

x :	-1	0	2	5
y :	9	5	3	15

(b) Find the interpolation $y = f(x)$ by Newton's divided difference formula for the following data and hence find $f(6)$: $(6 + 2 = 8)$

x :	1	2	-4
y :	3	-5	4

5. (a) Use Trapezoidal rule to evaluate $\int_0^1 x^3 dx$ considering 5 sub-intervals correct to two decimal places. Also determine the error using formula. $(5 + 3 = 8)$

(b) Evaluate $\int_0^1 \frac{dx}{1+x^2}$ using Simpson's $\frac{1}{3}$ rule. (7)

6. (a) Find the cube root of 20 by Newton-Raphson method. (5)

(b) Using bisection method find the root of the equation $x^3 + x + 1 = 0$. (5)

(c) Find a real root of the equation $x \log_e x - 2 = 0$ by Regula False Method. (5)

7. (a) Using Gauss-Jordan method, solve the system of equation. (7)

$x + 2y + z = 8$;

$2x + 3y + 4x = 20$;

$4x + 3y + 2x = 16$

(b) Solve $\frac{dy}{dx} = 2x + y$, $y(1) = 2$ by 4th order Runge-Kutta method at $x = 1.2$. (8)

Or

Solve $\frac{dy}{dx} = \frac{y}{x} + 1$, $y(1) = 2$ at $x = 1.2$ by Euler's predictor-corrector formula.
