

Numerical Methods

Duration: 45 Minutes

Maximum marks: 30

Q.1 - Q.10 Carry One Mark each.

- A root is to be calculated for the equation $x^3 - 3x - 5 = 0$ by using Newton-Raphson method. If initial approximation of x is 2 then next approximation of x is _____
- Consider $f(x) = e^{-x}(3.2 \sin x - 0.5 \cos x)$ in the interval (3,4) the third approximation value of x is _____ [upto 3 decimals]
- Using Newton-Raphson method with $x_0 = -1$, the function $f(x) = x^2 - 4$ will converge to
 (A) -2 (B) 2 (C) 0 (D) Does not converge
- $\sqrt[3]{7}$ is to be calculated by Newton-Raphson method with starting value of x as 2. At the end of first iteration, value of x is _____.[upto three decimals]
- The polynomial $f(x) = x^5 + x + 2$ has _____ number of complex roots.
- In the interval $[0, -\pi]$, the equation $x = \cos x$ has
 (A) No solution (B) Exactly one solution (C) Exactly 2 solutions (D) Infinite number of solutions
- Consider $f(x) = x^3 - 2x - 5 = 0$ to find root of $f(x)$ in interval $[2, 3]$, regular - false method is used in interval second approximated value of root is _____ [upto 3 decimals]
- Nature of convergence of regula falsi method is
 (A) Quadratic (B) Cubic (C) Linear (D) None of these
- The iterative algorithm approximated root 'c' using regular -fast method for function $f(x)$ in interval (a, b) is
 (A) $c = \frac{bf(b) - af(a)}{b - a}$ (B) $c = \frac{bf(b) - f(a)}{b - a}$ (C) $c = \frac{bf(b) - af(a)}{f(b) - f(a)}$ (D) $c = \frac{af(b) - bf(a)}{f(b) - f(a)}$
- Given that one root of equation is -3 then the product of remaining roots is _____

Q.11 - Q.20 Carry Two Mark each.

- Consider the Differential equation $\frac{dy}{dx} = 1 + y^2; y(0) = 0$ and $h = 0.1$. The value of $y(0.1)$ by using Runge-kutta method of fourth order is _____ [upto five decimals]

12. $x^4 - 4x^3 - 9 = 0$, using N - R method ,the iterative equation where k indicates iterative level is

(A) $\frac{(3x_k^2 - 8x_k) + \frac{9}{x_k^2}}{4x_k - 12}$

(C) $\frac{(3x_k^2 - 8x_k) + \frac{9}{x_k}}{4x_k^2 - 12}$

(B) $\frac{(2x_k^3 - 8x_k^2) + \frac{9}{x_k^2}}{4x_k - 12}$

(D) None of these

13. The table of x Vs y is given below

x	3	4	5	6	7
y	2.7	6.4	12.5	21.6	34.3

If the above table represents the series with $y=34.3$ at $x=7$ represents the 7th term of series, the 10th term of the series is _____.

14. For $m=0, 1, 2, \dots$ the steps of Newton-Raphson method for solving a non-linear equation is given as $x_{k+1} = \frac{2}{3} x_k + \frac{5}{3} x_k^{-2}$ starting from initial choice . As $k \rightarrow \infty$.The iterate x_k tends to _____.

15. Consider the differential equation $\frac{dy}{dx} = 2(x + y^2)$, $y(0) = 1$, $h = 0.05$

The Value of y (0.1) using forward Euler method is _____ [up to two decimals]

16. A The N-R iteration

$x_{n+1} = \frac{1}{2} \left[x_n + \frac{R}{x_n^2} \right]$ can be used to compute

(A) Square of R

(C) Cube root of R

(B) Cube of R

(D) Square root of R

17. While numerically solving the Differential equation $\frac{dy}{dx} + 2x^2y = 0$, $y(0) = 1$ using Euler's predictor-corrector (Improved Euler-Cauchy) method with step size of 0.3. The value of y after the first step is _____ [up to five Decimals]

18. There is no value of x that can satisfy all the three equations. Therefore, find the 'least squares error' solution to the three equations i.e. find the value of x that minimizes the sum of squares of errors in the three equations $3x=2$, $2x=1$, $4x=3$ is _____.

19. A For the Differential equation $\frac{dy}{dx} = 3 - \frac{y}{x}$ given the initial condition $y(1)=2$, the first approximation of y using second order R-K method for step size 0.2 is

(A) 2.3235

(C) 2.5

(B) 2.2166

(D) None of these

20. Only one real root of $f(x) = x^6 - x - 1$ lies in the interval $1 \leq x \leq 2$ and bisection method is used to find its value. For achieving an accuracy of 0.0001 the required minimum number of iteration is _____.

(A) 10

(C) 14

(B) 12

(D) 16