

[103]

SARDAR PATEL UNIVERSITY

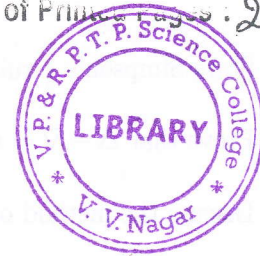
B.Sc. SEM- III EXAMINATION

31st December 2020, Thursday

02:00 p.m. to 04:00 p.m.

Sub.: Mathematics (US03CMTH21)

(Numerical Methods)



Maximum Marks: 70

Q.1 Choose the correct option in the following questions, mention the correct option in the answerbook. [10]

- (1) In iteration method the sequence of approximation converges to the root provided
 - (a) $|\phi'(x)| > 1$
 - (b) $|\phi'(x)| < 1$
 - (c) $|\phi(x)| \neq 1$
 - (d) $|\phi(x)| < 1$
- (2) The root of the equation $f(x) = x^3 - 2x - 5 = 0$ lies between
 - (a) 0 and 1
 - (b) -2 and -1
 - (c) 2 and 3
 - (d) 1 and 2
- (3) Central difference operator $\delta_{y_{1/2}} =$
 - (a) $y_1 - y_0$
 - (b) $y_{3/2} - y_{1/2}$
 - (c) $y_{5/2} - y_{3/2}$
 - (d) none
- (4) If $y_5 = 4$ and $y_{15} = 10$ then $E^5 y_{10} =$
 - (a) 10
 - (b) 5
 - (c) 15
 - (d) 20
- (5) In forward differences $\Delta^2 y_0 = \dots$
 - (a) $\Delta y_0 - \Delta y_1$
 - (b) $y_2 - 2y_1 + y_0$
 - (c) $y_2 + 2y_1 + y_0$
 - (d) $\Delta y_2 - \Delta y_0$
- (6) Name of the formula $y_p = y_0 + p\Delta y_{-1} + \frac{p(p+1)}{2!} \Delta^2 y_{-1} + \frac{p(p+1)(p-1)}{3!} \Delta^3 y_{-2} + \frac{p(p+1)(p-1)(p-2)}{4!} \Delta^4 y_{-2} + \dots$ is
 - (a) Newtons Forward
 - (b) Stirling
 - (c) Gauss Forward
 - (d) Gauss Backward
- (7) By putting $n = \dots$ in the General formula for integration, we get Simpson's $\frac{1}{3}$ rule.
 - (a) 1
 - (b) 2
 - (c) 3
 - (d) -1
- (8) Trapezoidal rule is obtain from.....
 - (a) Simpson's $\frac{1}{3}$ rule
 - (b) General formula for integration
 - (c) Simpson's $\frac{8}{3}$ rule
 - (d) Gauss formula
- (9) The Lagrange's interpolation formula is applicable for.....arguments.
 - (a) Equal spaced
 - (b) Unequal spaced
 - (c) positive
 - (d) negative
- (10) In general $[x_1, x_2] =$
 - (a) $[x_4, x_3]$
 - (b) $[x_3, x_3]$
 - (c) $[x_2, x_1]$
 - (d) None of these

Q.2 Do as directed. [08]

- (1) True or False: The divided differences are not symmetrical in their argument.
- (2) True or False: $\Delta + \nabla = \nabla \Delta$.
- (3) True or False: In the Newtons backward formula, $p = \frac{x-x_0}{h}$.
- (4) True or False: The Lagranges interpolation formula is only useful for unequal length of arguments.
- (5) If $y_6 = 10$ and $E^n y_2 = 10$ then $n = \dots$
- (6) $x_5 = x_4 - \frac{f(x_4)}{f'(x_4)}$ is approximation of method.
- (7) The interval $[-2, 2]$ is divided into 8 equal subintervals then the length of each subinterval is
- (8) ... is an interval containing an initial approximation for the root of an equation $x^3 - 4x - 9 = 0$.

Q.3 Attempt any ten in short: [20]

- (1) Define averaging and shift operators.

①

[P.T.O.]

- (2) State Simpson's $\frac{1}{3}$ rule.
- (3) Prove that $\Delta - \nabla = \delta^2$.
- (4) Discuss the method of successive approximations in short.
- (5) If $\phi(x) = (2x + 5)^{(1/3)}$ then find $|\phi'(x)|$ for $x=2.5$.
- (6) In usual notations show that $\Delta - \nabla = \Delta\nabla$.
- (7) State Newton's forward interpolation formula for equally spaced arguments.
- (8) Explain interpolation.
- (9) If $y_0 = 3, y_1 = -2, y_2 = 0, y_3 = 5$ then find $\Delta^3 y_0$.
- (10) Define divided differences.
- (11) State Lagrange's interpolation formula for unequal intervals.
- (12) Derive a formula to calculate the cube root of a number N .



Q.4 Attempt any Four:

[32]

- (a) Obtain the real root of the equation $x^3 + x^2 - 1 = 0$ correct upto three decimal points using bisection method.
- (b) Obtain the real root of the equation $x^3 - 4x - 9 = 0$ correct upto three decimal points using false position method.
- (c) Using Gauss's forward interpolation formula find $f(32)$, given that $f(25) = 0.2707, f(30) = 0.3027, f(35) = 0.3386, f(40) = 0.3794$.
- (d) Derive Newton's backward interpolation formula for equally spaced values of argument.
- (e) Using Lagrange's interpolation formula express the function $\frac{x^2 + x - 3}{x^3 - 2x^2 - x - 2}$ as sums of partial fraction.
- (f) Obtain first and second order numerical differentiation formula for Newton's forward difference formula.
- (g) Derive the general formula for numerical integration.
- (h) Evaluate $\int_0^1 \frac{1}{1+x} dx$, correct to three decimal places using Trapezoidal rule and by taking $h = 0.05$.

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