V.P. & R.P.T.P. Science College, V.V.Nagar

Internal Test: 2018-19

Subject : Mathematics US03CMTH02 Max. Marks : 50

Numerical Analysis

Date: 06/10/2018 Timing: 03.00 pm - 05.00 pm

Q: 1. Answer the following by choosing correct answers from given choices. 8

[1] For approximation of a root of an equation, intersection of a chord joining end points of graph of a function in an interval and the X-axis is used in

[A] False position method [B] Bisection method

[C] Iteration method [D] Aitkin's Δ^2-Process

[2] Initial approximation of a root of $x^3 - x - 2 = 0$ can be chosen from

[A] [0,1] [B] [-1,0] [C] [1,2] [D] [-2,-1]

[3] Which of the follwing is true?

[A] $\Delta y_5 = \nabla y_4$ [B] $\Delta y_5 = \nabla y_5$ [C] $\Delta y_4 = \nabla y_5$ [D] $\Delta y_6 = \nabla y_5$

[4] If $\Delta y_5 = 5$ and $y_6 = 11$ then $y_5 =$

[A] 16 [B] -16 [C] -6 [D] 6

[5] Langrange's Interpolation formula can be used for a data with _____ arguments.

[A] Rational [B] Irrational [C] only equally spaced [D] Unequally spaced

[6] For the given data

x	$x_0 = 3$	$x_1 = 4$	$x_2 = 5$	$x_3 = 6$	$x_4 = 7$	$x_5 = 8$
y	5	8	11	15	23	30

$[x_1\ x_2\ x_3] =$

[A] 1 [B] 2 [C] 3 [D] none

[7] In usual notations, if $I(h) = 5$ and $I(\frac{h}{2}) = 8$ then using Romberg's method, $I(h, \frac{h}{2}) =$

[A] 6 [B] 7 [C] 8 [D] 9

[8] Runge-Kutta method is used for finding a numeric

[A] integral [B] derivative [C] solution of a differential equation [D] none

Q: 2. Answer any FIVE of the following. **10**

[1] Find an interval containing an initial approximation of $x^3 - 4x + 1 = 0$

[2] Express $\sin x = 5(x + 2)$ in the form of $x = \phi(x)$, so that the necessary condition for applying the Iteration method is satisfied.

[3] If $y_{10} = 20$ and $y_9 = 15$ then find $\Delta y_9 - \nabla y_{10}$

[4] Prove that $\mu = \frac{1}{2}\left(E^{\frac{1}{2}} + E^{-\frac{1}{2}}\right)$

[5] Using Langrage's interpolation formula, find $y(x)$ for the data

x	4	5	7
y	10	-5	2

[6] Construct divided difference table for the data

x	2	3	4	5
y	10	15	18	20

[7] Using Trapezoidal rule find $\int_0^3 e^x dx$, with 3 subintervals of equal lengths.

[8] Using Simpson's $\frac{1}{3}$ rule find $\int_1^7 x dx$, with subintervals of length 1 unit.

Q: 3 [A] Discuss the Bisection method for approximation of root of an equation. 4

[B] Find a real root of $x^3 - 4x - 9 = 0$ by method of False Position correct upto three decimal places 4

OR

Q: 3 [A] Discuss the Aitken's Δ^2-Process for approximation of a real root of an equation. 4

[B] Find a real root of $2x = \cos x + 3$ by iteration method correct upto three decimal places 4

Q: 4 [A] Derive Newton's Forward Difference interpolation formula for equally spaced values of arguments. 4

[B] Use Gauss's forward formula to find y for $x = 30$ given that

x	21	25	29	33	37
y	18.4708	17.8144	17.1070	16.3432	15.5154

4

OR

Q: 4 [A] Derive Stirling's interpolation formula for equally spaced arguments. 4

[B] Locate and correct error in the following table of values

x	1	2	3	4	5	6	7	8
y	3010	3424	3802	4105	4472	4771	5051	5315

4

Q: 5 [A] Derive Newton's divided difference formula 4

[B] Using Langrange's interpolation formula express the following function as a sum of partial fractions

$$\frac{x^2 + 6x + 1}{(x-1)(x+1)(x-4)(x-6)}$$

4

OR

Q: 5 [A] Obtain 1^{st} and 2^{nd} order numerical differentiation formula from Newton's forward difference formula 4

[B] Tabulate $y = x^3$ for $x = 2, 3, 4, 5$ and calculate $\sqrt[3]{10}$ correct upto three decimal places 4

Q: 6 [A] Derive the formula of Simpson's $\frac{1}{3}$-rule for numerical integration. 4

[B] From the Taylor's series for $y(x)$, find $y(0.1)$ correct upto four decimal places if $y(x)$ satisfies $\frac{dy}{dx} = x - y^2$ and $y(0) = 1$ 4

OR

Q: 6 [A] Describe Picard's method of successive approximation 4

[B] Given that $\frac{dy}{dx} = x^2 + y,\ y(0) = 1$, determine $y(0.04)$ using Euler's modified method, correct upto four decimal places 4