

## B.Sc. (III-Semester) EXAMINATION 2022

Monday, 13-6-2022

12:00pm-2:00pm

US03CMTH21-Mathematics

Numerical Methods

Total Marks: 70

**Note:** Figures to the right indicates full marks of question.

**Q: 1 Answer the following by selecting the correct answer from the given options: [10]**

1.  $\sin x + 2 = 3x$  is known as ----- equation.  
a. algebraic      b. quadratic      c. transcendental      d. linear
2. The numerical difference between the true of quantity and its approximate value is called -----error.  
a. absolute      b. relative      c. percentage      d. syntax
3. ----- method is not used for finding root of an equation.  
a. Newton-Raphson      b. Simplex      c. Bisection      d. Iteration
4.  $\nabla y_{10} = 10, y_{10} = 25$  then  $y_9 =$  -----  
a. 15      b. -15      c. 5      d. -5
5.  $(1 + \Delta)(1 - \nabla) =$  -----  
a. 1      b. 0      c. 2      d. 3
6. The algebraic sum of any difference column in difference table is -----  
a. any number      b. 1      c. 2      d. zero
7. In the method of successive approximation  $P_1 =$  -----  
a.  $\frac{1}{\Delta y_0}(y_p - y_0)$       b.  $\frac{1}{h}(y_p - y_0)$       c.  $\frac{1}{\Delta y_0} y_4$       d.  $\frac{1}{\Delta y_0} y_0$
8. In general  $[x_3, x_4] =$  -----  
a.  $[x_4, x_3]$       b.  $[x_1, x_4]$       c.  $[x_3, x_2]$       d.  $[x_1, x_2]$
9. By putting  $n =$  ----- in the General formula for integration, we get Simpson's 3/8 rule.  
a. 1      b. 2      c. 3      d. -1
10.  $y_{n+1} = y_n + hf(x_n, y_n)$  is known as ----- 's method.  
a. Euler      b. Picard      c. Taylor      d. Runge-Kutta

**Q: 2 Do as Directed:**

[08]

1. For function  $f(x)$  if  $f(a) < 0, f(b) > 0$  then there exist -----  $x \in (a, b) \Rightarrow f(x) = 0$ .
2. True or False: Every polynomial of  $n^{th}$  degree has  $n$  and only  $n$  roots.
3. True or False:  $y_{n+4} = E^{-2}y_{n-2}$
4. In forward difference  $\Delta^2 y_0 =$ -----
5. True or False: Divided differences are symmetric of their arguments.
6. The Lagrange's interpolation formula is applicable for -----arguments.
7. For  $\int_0^6 \frac{1}{1+x} dx$  in Simpson's 1/3 rule with 4 strips, then  $h=$ -----
8. True or False: The Picard's method is for finding solution of algebraic equation.

**Q:3 Answer in brief of the following questions. (Any Ten)**

[20]

1. An approximation value of  $\pi$  is given by  $X_1 = \frac{22}{7} = 3.1428571$  and it's true value is  $X = 3.1415926$ . Find the absolute and relative errors.
2. If  $x_1 = 0.5, x_2 = 0.816497, x_3 = 0.741964$  then find  $x_4$  by using Aitkin's  $\Delta^2$  - process.
3. Derive the formula to obtain  $\sqrt{N}$  by using Newton-Raphson method.
4. Evaluate:  $\left(\frac{\Delta^2}{E}\right) x^3$
5. Prove:  $\mu = \frac{1}{2} \left[ E^{\frac{1}{2}} + E^{-\frac{1}{2}} \right]$
6. If  $y_0 = 1, y_1 = 2, y_2 = 11, y_3 = 34$  then find  $\Delta^3 y_0$ .
7. Given the set of tabulated points  $(x, y)$  which are  $(1, -3), (3, 9), (4, 30)$  and  $(6, 132)$ . Obtain the value of  $y$  at  $x=2$  using Newton's divided difference formula.
8. Using Lagrange's interpolation formula, find  $f(9)$  for the data:

x	2	4	7
y	10	26	65

9. State first and second order differentiation formula for Newton's forward interpolation formula.
10. Evaluate:  $\int_0^1 \frac{1}{1+x} dx$  by using Trapezoidal rule for  $h=0.5$
11. State second order Runge-Kutta formula.
12. Discuss the geometrical interpretation of Simpson's 1/3 rule.

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[P. T. O.]

**Q:4 Attempt any Four of the following.**

**[32]**

- 1) Discuss the Iteration method for approximation of a real root of an equation.
- 2) Find a real root of an equation  $x^3 - 4x - 9 = 0$  by method of False position, correct up to three decimal places.
- 3) Using Gauss's forward interpolation formula find  $f(32)$ , given that  $f(25) = 0.2707, f(30) = 0.3027, f(35) = 0.3386, f(40) = 0.3794$ .
- 4) Derive Stirling's interpolation formula for equally spaced values of arguments.
- 5) Obtain first and second order numerical differentiation formula for Gauss forward formula.
- 6) Tabulate  $y = x^3$  for  $x = 2, 3, 4$  and  $5$  and hence calculate  $\sqrt[3]{10}$ , hence correct up to three decimal places.
- 7) Determine the value of  $y$  when  $x = 0.1$  given that  $y(0) = 1$  and  $y' = x^2 + y, h = 0.05$  using Euler's modified method.
- 8) Derive the Simpson's 3/8 rule.

————— x —————

**[3 of 3]**

