BBH-003-1016003 Seat No. _____

B. Sc. (Sem. VI) (CBCS) Examination

July – 2021

Mathematics : Paper-10(A)

(Optimization & Numerical Analysis-II)

Faculty Code : 003
Subject Code : 1016003

Time : $2\frac{1}{2}$ Hours]   [Total Marks : **70**

Instruction : Answer any five questions

1   (A) Answer the following questions :   **4**
    1.   Define Objective function with respect to Linear
          Programming Problems.
    2.   Define Hyperplane in E^n.
    3.   Define Convex set.
    4.   Define Convex Hull.
    (B)   Write matrix form of Linear Programming Problems.   **2**
    (C)   Draw a sketch of the graph of following LPP :   **3**

    Maximize $Z = 5x_1 + 7x_2$ subject to $x_1 + x_2 \le 4, 3x_1 + 8x_2 \le 24,$

    $10x_1 + 7x_2 \le 35, x_1, x_2 \ge 0$

    (D)   Explain Simplex method to solve Linear Programming   **5**
          Problems.

2   (A) Answer the following questions :   **4**
    1.   Write standard form of Linear Programming
          Problems.
    2.   The linear function in any LPP that is to be
          optimized is called _____.
    3.   What is Degenerate B.F.S. ?
    4.   What is Non-generate B.F.S. ?

    (B)   Define Slack variables and Surplus variables.   **2**
    (C)   Explain steps of Graphical method to solve   **3**
          Linear Programming Problems.
    (D)   Explain Big-M method to solve Linear Programming   **5**
          Problems.

3   (A)   Answer the following questions: 4
        1.   What is the full form of NWCM ?
        2.   What is the full form of LCM ?
        3.   What is the full form of VAM ?
        4.   What is the name of the method to
             solve assignment problems ?
   (B)   Write mathematical form of transportation problem.   2
   (C)   Write three steps of NWCM.   3
   (D)   Explain Penalty method.   5

4   (A)   Answer the following questions :   4
        1.   Which variables are introduced to the LPP with
             $\leq$ type constraints ?
        2.   Which variables are introduced to the LPP with
             $\geq$ type constraints ?
        3.   Which method is better out of NWCM and LCM ?
             Give reason.
        4.   What is dual ?
   (B)   Explain Matrix Minima Method.   2
   (C)   Write six relationships between primal and dual   3
         LP problems.
   (D)   Obtain the dual problem of the following primal LP   5
         problem :

         Minimize $Z_x = 5x_1 + 2x_2 + x_3$ subject to $x_1 - 3x_2 + 4x_3 = 5,$

         $x_1 - 2x_2 + 0x_3 \leq 3 \ 0x_1 + 2x_2 - x_3 \geq 4$ and $x_1, x_2 \geq 0, x_3$
         is unrestrocted.

5   (A)   Answer the following questions :   4
        1.   Write Gauss forward interpolation formula.
        2.   Write Gauss backward interpolation formula
        3.   Write Sterling formula.
        4.   Write Bessel's formula.
   (B)   Which formula is used for inverse interpolation ?   2
   (C)   Obtain Laplace-Everett's formula.   3
   (D)   Use Langrange's formula to find the form of $f(x)$ 5
         given :

x	0	2	3	6
$f(x)$	648	704	729	792

6 (A) Answer the following questions : **4**

1. Write the formula of $f(x_2, x_3)$ in usual notations of the divided difference.

2. Write the formula of $f(x_0, x_1, x_2)$ in usual notations of the divided difference.

3. Write Lagrange's interpolation formula.

4. What is the drawback Lagrange's interpolation ?

(B) Write a relation of forward difference operator in terms of central difference operator and shifting operator and then write central difference operator in terms of shifting operator and forward difference operator. **2**

(C) If $f(x) = x^3$ then find $f(1,3,5,7)$. **3**

(D) Obtain the formula to interpolate the value of y for $0 < P < 1$. **5**

7 (A) Answer the following questions : **4**

1. What is numerical differentiation ?

2. To find $\int_a^b y \, dx$ called _____. Fill in the blank.

3. Write Trapezoidal rule.

4. Write Simpson's 1/3 rule.

(B) Obtain central difference table for the following data : **2**

x	60	75	90	105	120
$f(x)$	28.2	38.2	43.2	40.9	37.7

(C) Derive Trapezoidal rule. **3**

(D) Derive Simpson's 3/8 rule. **5**

8 (A) Answer the following questions : **4**

1. Write general quadrature formula.

2. Write Simpson's 3/8 rule.

3. Value of $\int_2^6 \frac{dx}{x} = $ _____ by trapezoidal rule. Fill in the blank.

4. Value of $\int_2^6 \frac{dx}{x} = $ _____ by Simpson's 1/3 rule. Fill in the blank.

(B) Find the value of $\int_0^{10} \frac{dx}{1 + x^2}$ by trapezoidal rule. **2**

(C) Prove : $D^3 = \frac{1}{h^3}[\Delta^3 - \frac{3}{2}\Delta^4 + \frac{7}{4}\Delta^5 + ...]$ **3**

(D) Obtain derivatives using Stirling's formula. **5**

9 (A) Answer the following questions : **4**
1. Write Taylor's formula to solve ordinary differential equation.
2. Write Picard's formula to solve ordinary differential equation.
3. Write Range's formula for K_0.
4. Write Range Kutta's formula to find K_0.

(B) Write two difference between Gauss-Backward interpolation and Lagrange's interpolation. **2**

(C) Explain Range's method. **3**

(D) Solve $\frac{dy}{dx} = 2e^x - y, y(0.1) = 2.010, y(0.2) = 2.040,$ **5**

$y(0.3) = 2.090$. Find $y(0.4)$ correct to three decimal places applying Milne's predictor method.

10 (A) Answer the following questions : **4**

1. Find y_0' by Taylor's method $\frac{dy}{dx} = y^2 - x, y(0) = 1.$

2. For $\frac{dy}{dx} = 3x + y^2, y(1) = 1.2$ by Range's method find k_1.

3. Write Euler's modified formula for y_2.

4. What is the improved Euler's formula for y_1 ?

(B) Using Picard's method solve $\frac{dy}{dx} = x + y$, solve **2**

first approximation. Initial condition is $y(0) = 1$.

(C) Explain Range Kutta method. **3**

(D) Explain Euler's method to solve ordinary differential equation. **5**

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