DR-003-2016003 Seat No. _____

B. Sc. (Sem. VI) (CBCS) (W.E.F. 2019) Examination

April - 2022

Mathematics : Paper-10 (A)

(Optimization & Numerical Analysis-II)

Faculty Code : 003

Subject Code : 2016003

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

Instruction : Answer all questions.

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

(1) What do you mean by Artificial variable ?

(2) What do mean by Standard form LPP ?

(3) Name three different methods to solve LPP.

(4) In the two-phase method, _____variable is never considered for re-entry in to the basis.

(B) Answer any one : **2**

(1) Define : (1) Unbounded Solution

(2) Optimum basis feasible solution.

(2) Define : (1) Slack Variable

(2) Surplus Variable

(C) Answer any one : **3**

(1) Explain Primal-dual relationship.

(2) Explain the graphical method for optimization.

(D) Answer any one : **5**

(1) Using Graphical method

Maximize $Z = 11x_1 + 9x_2$ subject to

$3x_1 + 2x_2 \leq 8, 2x + 3x_2 \leq 7$ and $x_1 \geq 0, x_2 \geq 0$

(2) The manager of an oil refinery must decide on the optimum mix of two possible blending processes of which the inputs and outputs per production run are as follows :

–	*Input*(*units*)	–	*Output*(*units*)	–
Process	*Crude A*	*Crude B*	*Gasoline X*	*Gasoline Y*
1	5	3	5	8
2	4	5	4	4

The maximum amount available of crudes A and B is 200 units and 150 units respectively. Market requirements show that at least 100 unit of gasoline X and 80 units of gasoline Y must be produced. The profits per production run from process 1 and process 2 are Rs. 300 and Rs. 400 respectively. Solve the LP problem by graphical method.

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

(1) What is called feasible solution in Transportation Problem?

(2) Riddhi found a transportation problem having three rows and five columns. Jigna asked her how many positive allocations be made for Basic Feasible Solution ? Anita spoke "Five" in between their talk. Riddhi replied "Nine." Jigna said "Fifteen" What is the correct answer ?

(3) Foram asks a question to Nisha, "What is called Optimal Solution in Transportation Problem ?" What is the correct answer ?

(4) "What is called degenerate B.F.S ?", Jayesh asked Chirag. What was the correct answer given by him ?

(B) Answer any one : **2**

(1) State mathematical form of transportation problem.

(2) Find the initial solution of the following transportation problem by NWCM.

	*W*1	*W*2	*W*3	*Supply*
*F*1	2	7	4	5
*F*2	3	3	1	8
*F*3	5	4	7	7
*F*4	1	6	2	14
Demand	7	9	18	34

(C) Answer any one : **3**

(1) Explain NWCM.

(2) Explain LCM.

(D) Answer any one : **5**

(1) Find the optimum solution of the following using MODI method.

	$W1$	$W2$	$W3$	*Supply*
$F1$	2	7	4	5
$F2$	3	3	1	8
$F3$	5	4	7	7
$F4$	1	6	2	14
Demand	7	9	18	34

(2) Explain Hungarian method.

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

(1) To interpolate near the middle of difference table which formula will be useful ?

(2) Write Gauss forward interpolation formula.

(3) Write the range of P for which the Gauss forward interpolation formula is useful.

(4) In which condition Laplace -Everett's formula can give accurate result ?

(B) Answer any one : **2**

(1) If $y_2 = 10, y_1 = 8, y_0 = 5, y_{-1} = 10$, then find $y_{\frac{1}{2}}$ using Gauss's forward interpolation formula.

(2) If $f(x) = x^3 - 2x,$ then find $f(2, 5, 9, 10)$.

(C) Answer any one : **3**

(1) Prove that divided differences are symmetric in all their arguments.

(2) If $f(x) = x^{-1}$ then show that $f(x_0, x_1, ..., x_n) = \dfrac{(-1)^n}{x_0 x_1 ... x_n}$

(D) Answer any one : **5**

(1) Taking $x = a, b, c, d$ find first three divided differences of

$$1/x^2$$

(2) Apply Lagrange's formula inversely to find the root of $f(x) = 0$ given that
$f(30) = -30, f(34) = -13, f(35) = 3, f(42) = 18$.

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

(1) $\left(\dfrac{dy}{dx}\right)_{at\ x=x_0}$ = _____. Fill in the blank.

(2) What is the general quadrature formula ?

(3) Which value of n in general quadrature formula gives trapezoidal rule ?

(4) Write Simpson's $\frac{3}{8}$ rule.

(B) Answer any one : **2**

(1) In usual notation prove that

$$D = \frac{1}{h}\left(\nabla + \frac{\nabla^2}{2} + \frac{\nabla^3}{3} + \frac{\nabla^4}{4} + \ldots\right)$$

(2) Find the value of $\int_2^6 \frac{dx}{x}$ by trapezoidal rule.

(C) Answer any one : **3**

(1) Derive general quadrature formula.

(2) In usual notation prove that $D^3 = \left[\nabla^3 + \frac{3}{2}\nabla^4 + \frac{7}{4}\nabla^5 + \ldots\right]$

(D) Answer any one : **5**

(1) Derive formula of derivatives using Newton's forward formula.

(2) Find Second derivative of $f(x)$ at 1.5 for the following table.

X	1.5	2	2.5	3	3.5	4
$F(x)$	3.375	7	13.625	24	38.875	59

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

(1) In Milne's predictor formula, integration is taken in the interval_____. Fill in the blank.

(2) Find the value of k_1 in the solution of

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

(3) Find the value of y *at* $x = 0.2$ by Euler's method :

$\frac{dy}{dx} = 2x + y, y(0) = 1$

(4) Write Milne's Corrector formula.

(B) Answer any one : **2**

(1) Explain Taylor's method to solve ordinary differential equation.

(2) Use Euler's modified method to obtain $y(0.25)$ given that $y' = 2xy, y(0) = 1$

(C) Answer any one : **3**

(1) Explain Picard's method to solve ordinary differential equation.

(2) Explain Euler's improved method.

(D) Answer any one : **5**

(1) Explain Range's method.

(2) Explain Range Kutta's method.
