21U5110S (Pages: 3) Name: ……..……

Reg: No: …..……..……

FIFTH SEMESTER B.Voc. DEGREE EXAMINATION, NOVEMBER 2023

(CUCBCSS- UG)

CC18U GEC5 OT15 – NUMERICAL ANALYSIS AND OPTIMIZATION TECHNIQUES

(Information Technology)

(2018 to 2020 Admissions – Supplementary/Improvement)

Time: Three Hours Maximum: 80 Marks

PART A

Answer ***all*** questions. Each question carries 1 mark.

1. What is absolute error?
2. What do you mean by floating point system? Give an example.
3. Give an example for transcendental equation.
4. Using bisection method find first two iterations for the root of the equation

$$x^3 - 9x + 1 = 0.$$

5. Write Newton's forward difference formula.
6. Define the shift operator E
7. Write the relation E and Δ.
8. Define slack variable.
9. State True or False: An assignment problem is a special type of transportation problem.
10. What do you mean by differences of a polynomial?

(10 × 1 = 10 Marks)

PART B

Answer any ***eight*** questions. Each question carries 2 marks.

11. What is the relation between divided differences and forward differences?
12. Write $\Delta^n(y_0)$ in terms of y.
13. Prove that $\nabla = 1 - E^{-1}$.
14. Use the method of false position to obtain the second approximation of a root

$$x^3 + x - 1 = 0.$$

15. Prepare the divided difference table for the following data

x	:	1	3	4	6	10
f(x)	:	0	18	58	180	920

16. Evaluate $\int_0^5 \frac{1}{4x+5}\, dx$ using Simpson's $\frac{1}{3}$ rule taking h = 0.5.
17. Explain Newton-Raphson method.

18. What is Newton's general interpolation formula?
19. Write down the relationship between primal and dual problem in LPP.
20. Find the dual of Maximize $Z = x_1 - x_2 + 3x_3$

    Subject to the constraints $x_1 + x_2 - x_3 \leq 10,\ x_1 - x_3 \leq 2.\quad x_1, x_2, x_3 \geq 0.$
21. What is Big M method?
22. State the difference between transportation problem and assignment problem.

(8 × 2 = 16 Marks)

PART C

Answer any ***six*** questions. Each question carries 4 marks.

23. Find the positive root of the equation $2x = \cos x + 3$, Correct to three decimal places using fixed point iteration method.
24. Show that (i) $\Delta = \nabla E$. (ii) $\delta = E^{\frac{1}{2}} - E^{-\frac{1}{2}}$.
25. Using Lagrange's interpolation formula, find the form of the function y(x) from the following table.

x	:	-2	-1	2	3
y	:	-12	-8	3	5

26. Form the Taylor's series for y(x). Find y(0.1) correct to four decimal places if y(x) satisfies $y' = 1 + xy, y = 1\ when\ x = 0$.
27. Solve the initial value $y' = x - y^2$; and $y(0) = 0$ to find y(0.8), using Picard's method.
28. Determine the value of y when x = 0.1 given that $y(0) = 1$ and $y^I = x^2 + y$ using Euler's method taking h = 0.05 in two steps.
29. Using divided difference formula, find the polynomial function satisfying the following data

x	:	-4	-1	0	2	5
y	:	1245	33	5	9	1335

    Hence find f(1).
30. Explain the assignment problem.
31. Find an initial basic feasible solution by Vogel's approximation method.

	To			Availability
From	16	19	12	14
	22	13	19	16
	14	28	8	12
Requirement	10	15	17	

(6 × 4 = 24 Marks)

PART D

Answer any ***two*** questions. Each question carries 15 marks.

32. Solve using Crout's method:

$$x + y + z = 9,$$
$$2x - 3y + 4z = 13,$$
$$3x + 4y + 5z = 40.$$

33. Evaluate $\int_0^2 \frac{1}{1+x^3}\,dx$ using

    (a) Trapezoidal rule taking h = 0.5.

    (b) Simpson's $\frac{1}{3}$ rule taking h = 0.5.

    (c) Simpson's $\frac{3}{8}$ rule taking h = 0.5.
34. (a) Use fourth order Runge – kutta method with h = 0.2 to find the value of y at x = 0.2, x = 0.4 and x = 0.6 given $\frac{dy}{dx} = 1 + y^2\ ;\ y(0) = 0.$

    (b) Given $\frac{dy}{dx} = 1 + y^2\ ;\ y(0) = 0.$ Compute y(0.8) using Milne's method.
35. Obtain an optimal solution to minimize cost.

	D_1	D_2	D_3	D_4	Supply
O_1	19	30	50	10	7
O_2	70	30	40	60	9
O_3	40	8	70	20	18
Demand	5	8	7	14	

(2 × 15 = 30 Marks)

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