

SECOND SEMESTER UG DEGREE EXAMINATION, APRIL 2026

(FYUGP)

(Regular/Supplementary/Improvement)

CC24UBCA2CJ103 - NUMERICAL ANALYSIS AND OPTIMIZATION TECHNIQUES

(Computer Application - Major Course)

(2024 Admission onwards)

Time: 2.0 Hours

Maximum: 70 Marks

Credit: 4

Part A (Short answer questions)Answer **all** questions. Each question carries 3 marks.

1. What is the difference between absolute error and relative error? [Level:1] [CO1]
2. Use Newton-Raphson method to find x_1 where $f(x) = x^3 + x - 1$ and $x_0 = 1$. [Level:2] [CO1]
3. Write the Trapezoidal Rule formula to approximate $\int_a^b f(x)dx$. Why the name Trapezoidal is used for this method. [Level:2] [CO2]
4. Find an approximation to $\int_0^2 x dx$ by using Simpsons 1/3 Rule with $n = 2$. [Level:2] [CO2]
5. What is meant by Operations Research? [Level:1] [CO3]
6. In a hospital, meals are served twice to the patient's. Each gram of the first meal contain 10 units of protein and 20 units of vitamins. Whereas each gram of the second meal contains 15 units of protein and 15 units of vitamins. In a day's meal each patient should get at least 50 units of vitamins and 60 units of protein. Formulate the linear programming problem to determine the amounts of the two meals with the minimum cost when the cost of each gram of the first meal is Rs. 6.00 and that of the second is Rs. 5.00. [Level:2] [CO3]

7. Pivot on **4** in the simplex table

x_1	x_2	x_3	s_1	s_2	z	
1	2	4	1	0	0	56
2	2	1	0	1	0	40
-1	-3	-2	0	0	1	0

 [Level:2] [CO3]

8. Find an initial basic feasible solution for the following transportation problem using North West Corner method. [Level:2] [CO4]

	M_1	M_2	M_3	Supply
W_1	15	12	10	100
W_2	8	17	15	70
W_3	9	11	6	150
Demand	120	90	110	

9. Verify whether the following transportation problem is balanced. If not balance the transportation problem. [Level:2] [CO4]

Source	M 1	M 2	M 3	Supply
W 1	12	10	22	50
W 2	6	13	19	100
W 3	5	22	7	60
Demand	100	40	50	

10. Convert the following Assignment Problem to Transportation Problem. [Level:2] [CO5]

	Person 1	Person2	Person3	Person4
<i>Job1</i>	14	5	8	7
<i>Job2</i>	2	12	6	5
<i>Job3</i>	7	8	3	9
<i>Job4</i>	17	5	19	4

(Ceiling: 24 Marks)

Part B (Paragraph questions/Problem)

Answer *all* questions. Each question carries 6 marks.

11. Solve $x^3 - x - 1 = 0$ for the root between $x = 1$ and $x = 2$ by bisection method. [Level:2] [CO1]
12. Using regula-falsi method, find a real root of the equation $x^3 - 5x - 7 = 0$ between $x = 2$ and $x = 3$. [Level:2] [CO1]
13. State Simpsons 3/8 Rule. Use it to approximate $\int_0^2 2x + 1 dx$ with $n = 6$. [Level:2] [CO2]
14. Find Lagranges interpolating polynomial of degree three by using the points $f(1) = -3$, $f(3) = 0$, $f(4) = 30$, $f(6) = 132$. Hence find $f(5)$. [Level:2] [CO2]
15. Formulate the dual of the following linear programming problem. [Level:2] [CO3]
- Minimize: $z = x - 12z$
 Subject to: $3x + 5y - z \leq 10$
 $x + y + 4z \geq 12$
 $4x + 8z \geq 8$
 $x, y, z \geq 0$

16. Use graphical method to find the solution of the linear programming problem.

[Level:2] [CO3]

Maximize: $z = x + y$

Subject to: $5x + 2y \leq 10$

$4x + 3y \leq 12$

$x, y \geq 0$

17. Find an initial basic feasible solution for the following transportation problem using Least Cost method.

[Level:2] [CO4]

	A	B	C	D	Supply
1	15	10	12	22	250
2	18	8	17	10	300
3	12	16	25	9	200
Demand	150	200	125	275	

18. Solve the following Assignment Problem to find the optimum assignment.

[Level:2] [CO5]

	W1	W2	W3	W4
J_1	80	70	75	72
J_2	75	75	80	85
J_3	78	78	82	78

(Ceiling: 36 Marks)

Part C (Essay questions)

Answer any **one** question. The question carries 10 marks.

19. Using Newtons forward difference interpolation formula evaluate $f(1.5)$ for the following data.

[Level:3] [CO2]

x	0	1	2	3	4	5
f(x)	-3	3	11	27	57	107

20. Find the optimum solution for the following transportation problem.

[Level:3] [CO4]

	M_1	M_2	M_3	M_4	Supply
W_1	90	90	100	100	200
W_2	50	70	130	85	100
Demand	70	100	100	30	

(1 × 10 = 10 Marks)
