BRAINWARE UNIVERSITY

Course – B. Tech. (CS)

Numerical Analysis and Operations Research (M101)

(Semester – 1)

Time allotted: 3 Hours **Full Marks: 70**

[The figure in the margin indicates full marks. Candidates are required to give their answers in their own words as far as practicable.]

Group –A

(Multiple Choice Type Questions)

10 x 1 = 10

1. *Choose the correct alternative from the following*

(i) Operations Research attempts to find the best and _____ solution of a problem.

a. Optimum b. Degenerate

c. Perfect d. none

(ii) A given TP is said to be unbalanced, if the total supply is not equal to the total _____.

a. Optimization b. Demand

c. Cost d. None of these

(iii) The convergence of which of the following method is sensitive to starting value?

a. False position b. Gauss seidel method

c. Newton-Raphson method d. All of these

(iv) A feasible solution is called a basic feasible solution if the number of non-negative allocations is equal to _____ .

a. m-n+1 b. m+n-1

c. m+n+1 d. m-n-1

(v) The process of finding the values inside the interval (X_0, X_n) is called _____ .

a. Interpolation b. Extrapolation

c. Iterative d. Polynomial equation

(vi) LU Matrix Factorization method is used to solve _____.

a. Algebraic equation b. Transcendental equation

c. Linear equation d. Differential equation

(vii) The condition for Gauss Seidel and Gauss Jacobi is _____.

a. $|a_{ii}|>\sum|a_{ij}|$ where i!=j and i,j=1,2,…,n
b. $|a_{ii}|<\sum|a_{ij}|$ where i!=j and i,j=1,2,…,n
c. $|a_{ii}|>\sum|a_{ij}|$ where i=j and i,j=1,2,…,n
d. $|a_{ii}|<\sum|a_{ij}|$ where i=j and i,j=1,2,…,n

(viii) Test condition for convergence in Gauss Jacobi is:

a. $|x_i^{(n+1)} - x_i^{(n)}|$
b. $|x_i^{(n-1)} + x_i^{(n+1)}|$
c. $|x_i^{(n)} - x_i^{(n+2)}|$
d. $|x_i^{(n+2)} - x_i^{(n)}|$

(ix) In simplex method, we add _____ variables in the case of '='.

a. Slack Variable
b. Surplus Variable
c. Artificial Variable
d. None of the above

(x) Dual of the dual is _____.

a. Primal
b. Dual
c. Alternative
d. None of these

Group – B

(Short Answer Type Questions)
(Answer any *three* from the following)

3 x 5 = 15

2. Compute the value of y for x=0.6742 using Lagrange Interpolation formula.
x:3.5 4.0 4.8 5.6
y: 0.5441 0.6020 0.6812 0.7482 [5]

3. Evaluate $\int_0^1 (4x - 3x^2)\, dx$ taking 10 intervals by Trapezoidal rule. [5]

4. A travelling salesman has to visit 5 cities. He wishes to start from a particular city, visit each city once and then return to his starting point. Cost of going from one city to another is given. Find the least cost route.

	A	B	C	D	E
A	-	4	10	14	2
B	12	-	6	10	4
C	16	14	-	8	14
D	24	8	12	-	10
E	2	6	4	16	-

[5]

5. A company makes two products (say, P and Q) using two machines (say, A and B). Each unit of P that is produced requires 50 minutes processing

time on machine A and 30 minutes processing time on machine B. Each unit of Q that is produced requires 24 minutes processing time on machine A and 33 minutes processing time on machine B. Machine A is going to be available for 40 hours and machine B is available for 35 hours. The profit per unit of P is \$25 and the profit per unit of Q is \$30. Company policy is to determine the production quantity of each product in such a way as to maximize the total profit given that the available resources should not be exceeded. Formulate the problem of deciding how much of each product to make in the current week as an LP. [5]

6. Obtain dual of the given LPP:
Max $z= x_1-3x_2+5x_3$
$x_1+x_2+x_3<=7$
$x_1-x_2+x_3>=2$
$3x_1-x_225x_3= -5$
$x_1, x_2>=0$ and x_3 is unrestricted. [5]

Group – C

(Long Answer Type Questions)
(Answer any *three* from the following)

3 x 15 = 45

7. (a) Find the root of $4x-e^x=0$ that lies between 2 and 3, by Newton Raphson method. [8]
   (b) Find a root of the equation $x^3+2x - 2=0$, by False Position Method, correct upto 3 significant figures. [7]
8. (a) Solve the system of linear equation using Gauss elimination method correct upto 3 places of decimal.
   x+2y+z=0
   2x+2y+3z=3
   -x-3y=2 [7]
   (b) Solve the system of linear equation using Gauss Seidel iterative method.
   x+y+4z=9
   8x-3y+2z=20
   4x+11y-z=33 [8]
9. (a) Calculate the value of $\int_0^1 \frac{x}{1+x}\,dx$ using Simpson's One -Third Rule correct upto 3 significant figures, taking ten intervals. [7]
   (b) Find the value of $\int_0^{0.6} e^x\,dx$ correct upto five significant figures using Simpson's 3/8th rule. Compute absolute error. [8]
10. (a) Solve the given LPP using simplex method.
   Max z=6x+10y
   Sub to 3x+5y<=10
   5x+3y<=15
   x, y>=0 [7]
   (b) Solve the given LPP using Big M method
   Maximize $z=2x_1+3x_2+x_3$
   $-3x_1+2x_2+3x_3=8$
   $-3x_1+4x_2+2x_3=7$
   $x_1,x_2,x_3>=0$ [8]

11. (a) Solve the following transportation problem using both North West Corner Rule and VAM. Which solution is better?

	D1	D2	D3	Ai
O1	5	1	8	12
O2	2	4	0	14
O3	3	6	7	4
Bj	9	10	11	

[4+4]

(b) Using the following cost matrix, determine optimal job assignment and the cost of assignment.

	J1	J2	J3	J4	J5
A	8	4	2	6	1
B	0	9	5	5	4
C	3	8	9	2	4
D	4	3	1	0	3
E	9	5	8	9	5

[7]