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PG/2nd Sem/MCA-205/24

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M.Sc. 2nd Semester Examination

MCA

PAPER : MCA-205

( Numerical Methods and Optimization Technique )

Full Marks : 100

Time : 3 hours

The figures in the right-hand margin indicate marks.

Answer from **both** the Sections.

**SECTION—A**

( Numerical Methods )

( Marks : 36 )

**GROUP—A**

Answer *any* **three** questions : 2×3=6

1. Divide 27 by 13.1 and show the result up to six significant digits.
2. Rounding off the following numbers up to five significant figures :

49.380564, 121.95801

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( Turn Over )

( 2 )

- 3. Convert 5545 to base 8 to base 4.
- 4. Define absolute and percentage errors with example.
- 5. Write the Newton-Raphson formula to find a root of a linear equation  $f(x)$ .

**GROUP—B**

Answer *any two* questions : 15×2=30

- 6. (a) Find the root using bisection method (correct up to four decimal places) for the equation  $f(x) = \sin x$ .
- (b) Find by Euler's method, the value of  $y$  for  $x = 0.3$  from the differential equation

$$\frac{dy}{dx} = \frac{y}{x}$$

given  $y = 1$ , when  $x = 0$ , taking step length 0.1. 7+8=15

- 7. (a) Find the value of

$$\int_0^1 \frac{dx}{1+x^2}$$

taking five subintervals by trapezoidal rule, correct up to five significant digits.

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- (b) Find the eigenvalues and eigenvectors of the following matrix :

$$\begin{bmatrix} 1 & 1 & 4 \\ 3 & 2 & 1 \\ 2 & 1 & 1 \end{bmatrix}$$

Maximize  $Z = 3x_1^2 + 14x_1x_2 + 8x_2^2$

subject to

$$\begin{aligned} 3x_1 + 6x_2 &= 72 \\ x_1 \text{ and } x_2 &\geq 0 \end{aligned}$$

5+10=15

**[ Internal Assessment—30 ]**

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8. (a) Use the Big-M method to solve the following LP problem :

$$\begin{aligned} &\text{Minimize } Z = 2x_1 + x_2 \\ &\text{subject to} \end{aligned}$$

$$\begin{aligned} 3x_1 + x_2 &= 3 \\ 4x_1 + 3x_2 &= 6 \\ x_1 + 2x_2 &= 3 \\ x_1 \text{ and } x_2 &\geq 0 \end{aligned}$$

- (b) Find the optimal solutions for the assignment problem with the following cost matrix :

	M1	M2	M3	M4	M5
J1	10	5	13	15	16
J2	3	9	18	13	6
J3	10	7	2	2	2
J4	7	11	9	7	12
J5	7	9	10	4	12

8+7=15

9. (a) Briefly discuss about the important features of genetic algorithm.

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- (b) Formulate the computation of derivative using Newton's backward difference formula. 8+7=15

8. (a) Derive Simpson's one-third rule for the numerical integration of a function.

- (b) From the following table, find the values of  $y$  and at  $x = 2.03$  :

$x$	1.96	1.98	2.00	2.02	2.04
$y$	0.7825	0.7739	0.7651	0.7563	0.7473

7+8=15

9. (a) Explain regula-falsi method geometrically.

- (b) Solve by Gauss-Seidel iteration method, the system

$$\begin{aligned} x_1 + x_2 + 4x_3 &= 9 \\ 8x_1 + 3x_2 + 2x_3 &= 20 \\ 4x_1 + 11x_2 + x_3 &= 33 \end{aligned}$$

up to three significant figures. 7+8=15

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**SECTION—B**

**( Optimization Technique )**

( Marks : 34 )

**GROUP—A**

Answer *any two* questions : 2×2=4

1. What is the difference between linear and nonlinear programming problems?
2. How do you solve a maximization problem as a minimization problem?
3. What is degenerate basic feasible solution?
4. State the Kuhn-Tucker conditions.
5. What do you mean by unconstrained optimization technique?

**GROUP—B**

Answer *any two* questions : 15×2=30

6. (a) Solve the following LPP by the simplex method :

$$\begin{aligned} &\text{Minimize } Z = x_1 + 3x_2 + 3x_3 \\ &\text{subject to} \\ &\quad 3x_1 + x_2 + 2x_3 = 7 \\ &\quad 2x_1 + 4x_2 = 12 \\ &\quad 4x_1 + 3x_2 + 8x_3 = 10 \\ &\quad x_1, x_2, x_3 \geq 0 \end{aligned}$$

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( Continued )

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- (b) Obtain the dual LP problem of the following primal LP problem :

$$\begin{aligned} &\text{Minimize } Z = x_1 + 3x_2 + 2x_3 \\ &\text{subject to the constraints} \\ &\quad 3x_1 + x_2 + 2x_3 = 7 \\ &\quad 2x_1 + 4x_2 = 12 \\ &\quad 4x_1 + 3x_2 + 8x_3 = 10 \end{aligned}$$

and  $x_1, x_2 \geq 0$ ;  $x_3$  unrestricted in sign. 10+5=15

7. (a) Determine the initial basic feasible solution for the following transportation problem by VAM method :

	D1	D2	D3	D4	Supply
S1	19	30	50	10	7
S2	70	30	40	60	9
S3	40	8	70	20	18
Demand	5	8	7	14	

- (b) Use the graphical method to solve the following LP problem :

$$\begin{aligned} &\text{Maximize } Z = 3x_1 + 4x_2 \\ &\text{subject to} \\ &\quad 4x_1 + 2x_2 = 80 \\ &\quad 2x_1 + 5x_2 = 180 \\ &\quad x_1 \text{ and } x_2 \geq 0 \end{aligned}$$

8+7=15

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