

## Numerical Techniques

MAAR

Con. 2629-08.

(REVISED COURSE)

CO-9517

(3 Hours)

[ Total Marks : 100

- N.B. (1) Question No. 1 is compulsory.  
 (2) Attempt any four out of remaining six questions.  
 (3) Make suitable assumptions if required and justify the same.  
 (4) Write programs in C/C++.

1. (a) Define Inherent, Truncation and Round-off error and give an example for each. 5  
 (b) Prove that 5

$$\text{i) } \mu = \frac{1}{2} [E^{\frac{1}{2}} + E^{-\frac{1}{2}}] \quad \text{ii) } \mu^2 = 1 + \frac{\delta^2}{4}$$

- (c) Using Picard's method solve 5

$$\frac{dy}{dx} = 1 + xy \text{ such that } y = 0 \text{ when } x = 0.$$

- (d) Derive Newton - Raphson formula. 5

2. (a) List the bracketing methods and open methods and find the real root of the equation  $x^3 - 4x - 9 = 0$  using bisection method correct to three decimal places. 10

- (b) Solve the following equations by Gauss - Seidel method.

$$27x + 6y - z = 85, \quad 6x + 15y + 2z = 72, \quad x + y + 54z = 110. \quad 10$$

3. (a) From the following table find the number of students who obtained marks less than 45. 10

Marks	30-40	40-50	50-60	60-70
No. of students	31	42	51	35

- (b) Using Newton's divided difference formula, find the value of  $f(9)$  from the following table. 10

x	5	7	11	13	17
f(x)	150	392	1452	2366	5202

4. (a) Write a program for Lagrange's interpolation method and using this formula, find the value of  $y$  when  $x = 10$  from the following table. 10

x	5	6	9	11
y	12	13	14	16

- (b) Fit a straight line to the following data by the method of least squares 10

x	1	2	3	4	5	6	7
y	0.5	2.5	2.0	4.0	3.5	6.0	5.5

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5. (a) The velocity of the train which starts from rest is given by the following table, the time being reckoned in minutes from the start and speed in km/hour. 10

Time	3	6	9	12	15	18
Velocity	22	29	31	20	4	0

Estimate approximately the distance covered in 18 minutes by Simpson's  $3/8^{\text{th}}$  rule.

- (b) Solve  $\frac{dy}{dx} = 3x^2 + 2y$  with  $x_0 = 0$ ,  $y_0 = 1$  by Euler's modified formula find the value of  $y$  when  $x = 0.1$  taking  $h = 0.05$ . 10

6. (a) Solve  $\frac{dy}{dx} = 4x^2 + y$  with initial conditions  $y(1) = 2$  and find  $y$  at  $x = 1.2$ ,  $x = 1.4$  by Runge - Kutta Method of Fourth Order taking  $h = 0.2$ . 10

- (b) Using the following data, find  $x$  for which  $y$  is minimum and find this value of  $y$ . 10

$x$	3	4	5	6	7	8
$y$	0.205	0.240	0.259	0.262	0.250	0.224

7. (a) Explain the propagation of errors. 5  
 (b) Derive Newton Cotes integration formula and also write a program Simpson's  $1/3^{\text{rd}}$  rule. 10  
 (c) Write a short note on Golden section search. 5