$x^3 + x - 1 = 0$ near x=1, using Regula - Falsi method.

c) Give the geometric interpretation of Simpson's $\frac{1}{3}$ rd rule.

9. a) Find the value of $\sqrt{2}$ using Newton-Raphson method correct up to three decimal places.

b) Solve the equation $\frac{dy}{dx} = x + y$ with initial condition y(0)=1 taking step length 0.1 to find y(0.2) by Predictor-corrector method.

c) Find the missing value from the following table :

x :	1	2	3	4	5
y :	7	–	27	40	55

(5+5+5)

10. a) Use finite difference method to solve boundary value problem :

$\frac{d^2y}{dx^2} + y + 1 = 0$ with y(0) = 0, y(1) = 0.

b) Find the maximum absolute error in computing $u = \frac{x^3y^2}{z}$ when x = y = z = 0.1 and $\Delta x = \Delta y = \Delta z = 0.002$

c) Use finite difference method to solve boundary value problem :

$\frac{d^2y}{dx^2} + y + 1 = 0$ with y(0) = 0, y(1) = 0. (5+5+5)

11. a) Evaluate $\int_0^1 \frac{1}{(1+x^2)}$ taking n=6 by Weddle's method and compute the approximate value of π.

b) Solve by Euler's method, the equation

dy/dx = x+y, y(0) = 0

Choose h = 0.2 and compute y(0.6)

c) Write a C program to solve the equation $x^3 - 3x - 5 = 0$ within (1, 2) by bisection method correct to 3 decimal places. (5+5+5)

2014

Numerical Methods

Time Alloted : 3 Hours *Full Marks : 70*

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

GROUP - A
(Multiple Choice Type Questions)

1. Choose the correct alternatives for any ten of the following: 10x1=10

i) The number 9.6506531 when round-off to 4 places of decimal will give
   a) 9.6506 b) 9.6507
   c) 9.6505 d) none

ii) The degree of precision of Simpson's $\frac{1}{3}$ rd rule is
   a) 1 b) 2 c) 3 d) 4

iii) If f(3) = $a + \Delta f(1) + \Delta^2 f(1)$ then a=
   a) f(0) b) f(1) c) f(2) d) f(3)

iv) When Newton-Raphson method fail for finding the root of the equation f(x) = 0?
   a) f(x) = 0 b) f(x) > 0 c) f'(x)<0 d) f'(x)=1

v) The relation between shift operator 'E' and forward difference operator 'Δ' is given by

a) $\Delta = 1+E$ b) $E = 1+\Delta$

c) $E = \Delta$ d) $E = \Delta + 2$

vi) In Newton's forward interpolation, the interval should be

a) Equally spaced b) Not equally spaced
c) May be equally spaced d) Both (a) and (b)

vii) The percentage error in approximation 5/3 to 1.6667 is

a) 0.06% b) 0.006% c) 0.6% d) 6%

viii) Runge-Kutta method is used to solve

a) An algebric equation
b) A first order ordinary differential equation
c) A first order partial differential equation
d) None of these

ix) Rounding off the number 0.03709157 correct upto 5 significant figure is

a) 0.03709 b) 0.037091 c) 0.037092 d) 0.0370

x) The truncation error of Euler's method is

a) O(h) b) $O(h^3)$ c) $O(h^2)$ d) $O(h^4)$

xi) Regula-Falsi method is

a) Conditionally convergent b) Divergent
c) Linearly convergent d) None of these

xii) If the interval of differencing in unity and $f(x)=ax^2$ (a is constant), which one of the following choices is wrong?

a) $\Delta f(x) = a(2x+1)$ b) $\Delta^2 f(x) = 2a$

c) $\Delta^3 f(x) = 2$ d) $\Delta^4 f(x) = 0$

GROUP - B

(Short Answer Type Questions)

Answer any *three* of the following 3x5=15

2. Use Lagrange's Interpolation formula to find the value of y=f(x) for

x=1, given in the following table :

x	0	2	3	5
y	0	8	15	35

3. (a) Prove that $\Delta.\nabla = \Delta - \nabla$

(b) Evaluate $\Delta^2 \cos 2x$ (3+2)

4. Find y(1.1) using Runge Kutta method of 4th order given as

$$\frac{dy}{dx} = x^2 + xy, y(1) = 1.h = 0.1$$

5. Solve x+y+z=1
2x-3y+4z=13
3x+4y+5z=40 by Gauss Elimination method.

6. The function y = sinx is tabulated as given below :

x :	0	$\frac{\pi}{4}$	$\frac{\pi}{2}$
Sinx :	0	0.70711	1.0

Find the value of $\sin\left(\frac{\pi}{3}\right)$ using Newton Backward interpolation.

GROUP - C

(Long Answer Type Questions)

Answer any *three* of the following questions. 3x15=45

7. a) Prove that $f(4) = f(3) + \Delta f(2) + \Delta^2 f(1) + \Delta^3 f(1)$

b) Find the polynominal of least degree which attains the prescribed values of the given points :

x :	0	1	2	3
y :	3	6	11	18

Hence find y for x =1.1

c) Explain the geometric interpretation of Bisection method for finding a real root of an equation. (3+5+7)

8. a) Write down the advantages and disadvantages of Newton-Raphson method. Derive the order of convergence of N - R method.

b) Find an approximate value of the root of the equation