

CS/B.Tech/CE/ME/CSE/IT/AUE/PE/CHE/BT/FT/CT/LT/
TT/APM/Even/M(CS)-401/2014

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) $f'(x) = 1$

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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 algebraic 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) $O(h^2)$ c) $O(h^3)$ 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 is 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

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$x=1$, 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 $y = \sin x$ 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 polynomial 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

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$x^3 + x - 1 = 0$ 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)