# QUESTION 2014

## GROUP – A
## (Multiple Choice Type Questions)

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

i) The relative percentage error in approximate representation of 4/3 as 1.33 is
a) 25% ✓b) 2.5% c) .25% d) 0.025%

ii) First order forward difference of a constant function is
✓a) 0 b) 4 c) 3 d) 1

iii) When the no 1.004355 is rounded to 5 decimal places then it becomes
✓a) 1.00436 b) 1.00435 c) 1.00434 d) None of these

iv) For Trapezoidal rule of numerical integration, the number of sub-intervals should be
a) Even b) Odd ✓c) Even or odd d) Multiple of three

v) When the Gauss elimination method is used to solve BX = A, B is transformed into
a) A lower triangular matrix b) Zero matrix
✓c) An upper triangular matrix d) None of these

vi) The order of convergence of Regula-falsi method is
a) 1 b). 1.52 ✓c) 1.62 d) 2

vii) Which of the following methods give faster convergence?
a) Gauss-Jacobi Method ✓b) Gauss-Seidel method
c) Gauss-Elimination Method d) Gauss-Jordan Elimination Method

viii) The condition of convergence for the method of fixed point iteration is
✓a) $|\varphi'(x)| < 1$ b) $|\varphi'(x)| > 1$ c) $|\varphi'(x)| \le 1$ d) $|\varphi'(x)| \ge 1$

ix) The truncation error in 4th order Runge-Kutta method is of the
a) $O(h^2)$ b) $O(h^3)$ c) $O(h^4)$ ✓d) $O(h^5)$

x) A System of linear equations is said to be diagonally dominant it its coefficient matrix satisfy
a) $|aii| \le \sum |aij|$ b) $|aii| \ge \sum |aij|$ c) $|aii| > \sum |aij|$ ✓d) $|aii| < \sum |aij|$

xi) If a number be rounded off to m decimal places, then the absolute error
✓a) $E_a \le \frac{1}{2}10^{-m}$ b) $E_a \le \frac{1}{2}10^{m}$ c) $E_a \ge \frac{1}{2}10^{-m}$ d) $E_a \ge \frac{1}{2}10^{m}$

xii) Weddle's rule gives exact result for a polynomial of degree
✓a) ≤5 b) = 6 c) ≤7 d) = 8

## GROUP – B
### (Short Answer Type Questions)

2. When h=1, prove that $\Delta\left\{\frac{1}{f(x)}\right\} = -\frac{\Delta f(x)}{f(x).f(x+1)}$

And hence or otherwise find the value of $\Delta^n\left(\frac{1}{x}\right)$

See Topic: INTERPOLATION, Short Answer Type Question No. 19.

3. Find the value of f(12) from the following table correct up to a decimal places:

| x: | 10 | 15 | 20 | 25 | 30 | 35 |
|---|---|---|---|---|---|---|
| f(x): | 35.3 | 32.4 | 29.2 | 26.1 | 23.2 | 20.5 |

See Topic: INTERPOLATION, Short Answer Type Question No. 20.

4. Using regular falsi method find a real root of $x^3 + 2x - 2 = 0$, correct upto four significant figures.

See Topic: ALGEBRAIC & TRANSCENTAL EQUATION, Long Answer Type Question No. 5.

5. Evaluate $\int_1^5 \log_{10} x\,dx$ taking 8 sub-intervals, correct upto four decimal places by simpson's 1/3rd rule.

See Topic: NUMERICAL INTEGRATION, Short Answer Type Question No. 2.

6. Compute $y(0, 2)$, from the equation $\frac{dy}{dx} = x - y$, $y(0) = 1$ taking h=0.1, by Runge-kutta method of fourth order, correct to five decimal places.

See Topic: NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL EQUATION, Short Answer Type Question No. 10.

## GROUP – C
### (Long Answer Type Questions)

7. a) Derive Newton's Forward Interpolation Formula.

b) The following table gives the distance in nautical miles of the visible horizon for the given heights in feet above the earth's surface:

| Height (x): | 100 | 150 | 200 | 250 | 300 | 350 | 400 |
|---|---|---|---|---|---|---|---|
| Distance (d): | 10.66 | 13.06 | 15.07 | 16.84 | 18.45 | 19.93 | 21.30 |

Find the value of d when x=390 feet.

See Topic: INTERPOLATION, Long Answer Type Question No. 15.

8. (a) Show that Newton-Raphson method has second order convergence.

(b) Solve the following system of equations by Gauss-Jacobi iteration method.

$$8x - y + z = 18$$
$$2x + 5y - 2z = 3$$
$$x + y - 3z = -6$$

See Topic: NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL EQUATION, Long Answer Type Question No. 9.

9. a) Evaluate $\int_0^1 \frac{dx}{1+x^2}$, by using simpson's 1/3 rule taking n=4 and hence find the value of $\pi$.

b) Solve by Gauss-seidel iteration method, the system

x+y+4z=9

8x–3y+2z=20

4x+11y–z=33

**a) See Topic: NUMERICAL INTEGRATION, Long Answer Type Question No. 4.**

**b) See Topic: NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL EQUATION, Long Answer Type Question No. 10.**

10. (a) Apply Euler's method to find the value of y at x=0.02 for the initial value problem $dy/dx = y + e^x$ with y(0) =0, taking h=0.01.

(b) Find the real root of the equation cosx = 3x–1 correct to 4 decimal places using successive approximation method.

**a) See Topic: NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL EQUATION, Long Answer Type Question No. 11.a).**

**b) See Topic: ALGEBRAIC & TRANSCENTAL EQUATION, Long Answer Type Question No. 3.**

11. a) Evaluate $\int_0^{\pi/2} \sqrt{1-0.162\sin^2\theta}\, d\theta$

Correct upto 4 decimal places by Trapezoidal rule, taking $n$ = 10.

(b) Computer the value of y at x=0.01 using Runge-kutta method of order 4 from the differential equation $dy/dx=x^2+y$ with y(0)= 1 and hence compare your result with the exact solution.

**a) See Topic: NUMERICAL INTEGRATION, Long Answer Type Question No. 5.**

**b) See Topic: NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL EQUATION, Long Answer Type Question No. 11.a).**