QUESTION 2017

GROUP – A
(Multiple Choice Type Questions)

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

i) The number of significant digits in 1.5034 is

a) 4 ✓b) 5 c) 6 d) 3

ii) Which of the following is true?

a) $\Delta = 1 - E$ b) $\nabla = E^{-1}$ ✓c) $\Delta.\nabla = \Delta - \nabla$ d) $E\left(e^{x+h}\right) = E\left(e^{x}\right)$

iii) If $f(x) = 2x^3 - 3x^2 + 4x + 5$, *then* $\Delta\{3f(x)\}$ (where h = 1) is

a) 8 b) 200 c) 12 d) 100

iv) After n bisection, the length of the subinterval, which contains x_n, is

a) $\frac{b-a}{2^n}$ ✓b) $\left|\frac{b-a}{2^n}\right|$ c) $\frac{b-a}{2^n - 1}$ d) $\left|\frac{b-a}{2^n - 1}\right|$

v) The error in Simpson's 1/ 3rd rule is of order

a) h b) h2 c) h3 d) h4

vi) Lagrange's Interpolation Formula is used for

a) equal interval b) unequal interval

✓c) both (a) & (b) d) none of these

vii) The order of convergence of the Newton-Raphson method is

a) 0 b) 1 ✓c) 2 d) 3

viii) When Gauss-Elimination is used to solve the system of linear equations which can be written in the form of AX = B, A is transformed to a

a) Lower triangular matrix b) Upper triangular matrix

c) Diagonal matrix d) none of these

ix) If $\pi/2$ be approximated by 1.572 then the relative error will be

a) 0.004 b) –0.004 c) 0.005 d) –0.005

x) Runge-Kutta method of fourth order is used to

a) interpolate b) solve an equation numerically

c) integrate a definite integral numerically ✓d) solve a first order ODE numerically

xi) If $\frac{dy}{dx} = x - y \;\&\; y(1) = 0$, then the value of y (1.1) by Euler method 9is

✓a) 0.1 b) 0.2 c) 0.3 d) 0.4

xii) One of the roots of the equation $x^2 + 2x - 2 = 0$ lies in between

a) 1 & 2 b) 0 & 0.5 c) 0.5 & 1 d) none of these

Group – B
(Short Answer Type Questions)

2. Show that $1 - e^{-hD} \equiv \nabla$, (the notations have their usual meanings)

See Topic: INTERPOLATION, Short Answer Type Question No. 11.

3. Evaluate $\int_1^5 \log_{10} x dx$ taking n = 6, correct up to four significant digits by Simpson's 1/3rd rule

See Topic: NUMERICAL INTEGRATION, Short Answer Type Question No. 15.

4. Deduce Trapezoidal rule (without error) in composite form by integrating Newton's Forward interpolation formula.

See Topic: NUMERICAL INTEGRATION, Short Answer Type Question No. 16.

5. For a given step length h write the expression for first order forward, backward and shift differences of $f(x)$ at x.

See Topic: INTERPOLATION, Short Answer Type Question No. 23.

6. Compute y (0.5), by Milne's predictor-corrector method from $\frac{dy}{dx} = 2e^x - y$, given that y(0.1) = 2.0100, y (0.2) = 2.0401, y (0.3) = 2.0907, y (0.4) = 2.1621

See Topic: NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL EQUATION, Short Answer Type Question No. 14.

Group – C
(Long Answer Type Questions)

7. a) Using LU factorization solve:

$$5x+2y+z=-12$$
$$x+4y+2z=20$$
$$2x-3y+10z=3$$

b) Find the root of $x^3-x-1=0$ correct to four decimal places using Newton-Raphson method.

c) Construct forward differences of all order for the polynomial $f(x)=x^3+2x$, taking step length $h=1$.

a) See Topic: ALGEBRAIC & TRANCENDENTAL EQUATION, Long Answer Type Question No. 3(b).

b) See Topic: ALGEBRAIC & TRANCENDENTAL EQUATION, Long Answer Type Question No. 22.

c) See Topic: INTERPOLATION, Long Answer Type Question No. 18.

8. a) Solve by Gauss-elimination iteration method (up to two iteration):

$$2x-3y+z=-1$$
$$x-y-z=1$$
$$3x+y-z=2$$

b) Use Bisection method, to find a positive root of the equation $3x^2+2x-9=0$, correct to two decimal places.

c) Prove that Newton-Raphson method has a quadratic convergence.

a) See Topic: ALGEBRAIC & TRANCENDENTAL EQUATION, Long Answer Type Question No. 23.

b) See Topic: ALGEBRAIC & TRANCENDENTAL EQUATION, Long Answer Type Question No. 24.

c) See Topic: ALGEBRAIC & TRANCENDENTAL EQUATION, Long Answer Type Question No. 21(L).

9. a) Solve the equation by Taylor's series method for x = 0.2

$$\frac{dy}{dx}=\sin(xy)-1;\ y(0)=1.2$$

Express the result correct to 3 places of decimal.

b) Using Gauss-Seidal method solve the following system of linear equations:

$$10x+2y+z=9$$
$$x+10y-z=-22$$
$$-2x+3y+10z=22$$

a) See Topic: NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL EQUATION, Long Answer Type Question No. 15.
b) See Topic: ALGEBRAIC & TRANCENDENTAL EQUATION, Long Answer Type Question No. 25.

10. a) Use Newton's Divided difference formula to find the value of f(1.25) from the following data:

x:	1.0	1.1	1.3	1.5	1.6
f(x):	0.364	0.326	0.261	0.209	0.188

b) Find the missing terms in the following table:

x	45	50	55	60	65
y	3	?	2	?	4

c) Using modified Euler's method solve the following equation at x = 1.2:

$$\frac{dy}{dx}=\frac{1-xy}{x^2}, y(1)=1$$

By taking h = 0.1, correct up to 3 decimal places.
a) See Topic: INTERPOLATION, Short Answer Type Question No. 10.
b) See Topic: INTERPOLATION, Short Answer Type Question No. 18.
c) See Topic: NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL EQUATION, Long Answer Type Question No. 16.

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

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

b) Evaluate $\int_0^{0.5}\sqrt{\frac{1-0.75x^2}{1-x^2}}dx$ by Trapezoidal rule, taking $n=5$.

c) Write down the general rules for rounding off a number to n-significant figures
a) See Topic: INTERPOLATION, Short Answer Type Question No. 20.
b) See Topic: NUMERICAL INTEGRATION, Long Answer Type Question No. 7.
c) See Topic: NUMERICAL METHODS & ALGORITHMS, Short Answer Type Question No. 2.