

**Raniganj Girls' College**  
**Department of Mathematics**  
**6<sup>TH</sup> SEMESTER B.SC. UG Examination**

**6<sup>TH</sup> Semester(Honours)**

**Subject: MATHEMATICS**

**Paper Name: NUMERICAL ANALYSIS**

**Paper Code: BSCHMTMC601**

**Full Marks: 40**

**Time: 2 hours**

| Q.No |                                                                                                                      | Marks  |
|------|----------------------------------------------------------------------------------------------------------------------|--------|
| 1.   | <i>Answer any <b>five</b> questions from the following:</i>                                                          | 5X1=5  |
| (a)  | Round-off the following numbers to three significant figures:<br>0.01201 , -239.85                                   |        |
| (b)  | Prove that $\Delta \nabla = \Delta - \nabla$                                                                         |        |
| (c)  | Define the shift operator $E^{-1}$ .                                                                                 |        |
| (d)  | What is polynomial interpolation?                                                                                    |        |
| (e)  | Suppose that $f(x)$ is a polynomial of first degree. What is the error of computing $\int_a^b f(x)dx$ by             |        |
| (f)  | Trapezoidal Rule?                                                                                                    |        |
| (g)  | What is pivoting?                                                                                                    |        |
| (h)  | What is Transcendental equation? Give an example.                                                                    |        |
|      | If $\Delta r = \Delta h = 0.001$ find the absolute error in $v = \frac{1}{3}\pi r^2 h$ , where $r = 2$ and $h = 3$ . |        |
| 2.   | <i>Answer any <b>five</b> questions from the following:</i>                                                          | 5X2=10 |
| (a)  | If a number 0.000012 is approximated to 0.000009 find the number of significant digits for such approximation.       |        |
| (b)  | Subtract 203.176 from 791.23                                                                                         |        |
| (c)  | Calculate $\Delta^2(ax^2 + bx + c)$ .                                                                                |        |
| (d)  | What is meant by the degree of precision of a quadrature formula?                                                    |        |
| (e)  | State geometrical significance of Trapezoidal rule for numerical integration.                                        |        |
| (f)  | Comment on accuracy of Euler's method in solving differential equations.                                             |        |
| (g)  | What is rate/order of convergence of iterative method?                                                               |        |
| (h)  | What is LU-factorization method?                                                                                     |        |

Q.No

Marks

3. **Answer any three questions from the following:**

3X5=15

- (a) Find the relative error in computing  $f(x) = x^2 - 5x$  for  $x = \sqrt{3}$  taking  $\sqrt{3} = 1.73$
- (b) Using N-R method, calculate  $2^{\frac{1}{5}}$  correct up to three significant figures.
- (c) What is the lowest degree polynomial which takes the following values:

|        |   |   |   |    |    |    |
|--------|---|---|---|----|----|----|
| $x$    | 0 | 1 | 2 | 3  | 4  | 5  |
| $f(x)$ | 1 | 4 | 9 | 16 | 25 | 36 |

- (d) Find approximate value of  $\int_1^2 \frac{1}{x} dx$  by Simpson's one third rule taking 4 Sub-intervals.
- (e) Find by Euler's method, the value of  $y$  for  $x = 0.3$  from the differential equation  $\frac{dy}{dx} = \frac{y-x}{y+x}$ . Given that  $y = 1$  when  $x = 0$  taking step length 0.1.

4. **Answer any three questions from the following:**

1X10=10

- (a)(i) Prove that  $\Delta^k f(x) = \sum_{i=0}^k (-1)^i \binom{k}{i} f(x - ih)$  hence deduce  $\Delta^k y_n = \sum_{i=0}^k (-1)^i \binom{k}{i} y_{n-i}$  (4+1)

- (ii) If  $f(x) = \frac{1}{x^2}$  find the divided difference  $f(a, b)$ ;  $f(a, b, c)$  and  $f(a, b, c, d)$ . 5

- (b) Find the quadrature formula in the form  $\int_0^1 \frac{f(x)dx}{\sqrt{x(1-x)}} = \alpha_1 f(0) + \alpha_2 f\left(\frac{1}{2}\right) + \alpha_3 f(1)$  which is exact for polynomial of highest possible degree. Then using the formula, evaluate the following integral  $\int_0^1 \frac{dx}{\sqrt{x-x^3}}$ . 10

- (c)(i) Solve the following system of equations

$x_1 + x_2 + x_3 = 6$ ;  $3x_1 + (3 + \varepsilon)x_2 + 4x_3 = 20$ ;  $2x_1 + x_2 + 3x_3 = 13$  Using the Gauss elimination method where  $\varepsilon$  is small such that  $1 \pm \varepsilon^2 = 1$ .

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- (ii) Discuss the convergence of Regular-Falsi Method.

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