BRAINWARE UNIVERSITY

Term End Examination 2025-2026
Programme – B.Tech.(BT)-2024/B.Tech.(BT)-2025
Course Name – Numerical Methods
Course Code - BBS00023
(Semester II)

Full Marks : 60 **Time : 2:30 Hours**

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

Group-A
(Multiple Choice Type Question) 1 x 15=15

1. *Choose the correct alternative from the following :*

(i) Select the correct option. After being rounding off to three places of decimal the number 57.1092 becomes__

a) 57.109 b) 57.100
c) 57.110 d) 0.109

(ii) Select the error if 0.0081 is the approximate value of 0.00809.

a) 0.001 b) 0.00001
c) -0.00001 d) None of these

(iii) Select the correct option. The result after rounding off to five decimal places of decimals of the number 15.231865 is__

a) 15.23196 b) 15.23187
c) 15.23186 d) None of these

(iv) Select the correct option. The error in Trapezoidal rule in evaluating $\int_a^b f(x)dx$, is of order

a) h^2 b) h^3
c) h^4 d) h

(v) If 9.8 is approximated value of 9.79, then the percentage error becomes__. Select the correct option.

a) -0.01 b) 0.01
c) 0.00102145 d) 0.102145

(vi) Select the correct option.

If and error in , are 0.01, 0.02 respectively at , then the maximum absolute error in evaluating is __.

a) 0.04 b) 0.03
c) 0.01 d) None of these

(vii) Select the correct option. Newton Raphson method is also known as__

a) normal method
b) tangent method
c) parallel method
d) none of these.

(viii) If Δ and ∇ are the forward and backward difference operators respectively, then $\Delta - \nabla$ is equal to__. Select the correct option.

a) $\Delta + \nabla$
b) $\Delta . \nabla$
c) $-\Delta . \nabla$
d) $\frac{\Delta}{\nabla}$

(ix) Identify the second-degree polynomial that passes through the points (0,1), (1,3), (2,7), (3,13).

a) $x^2 + 2x + 2$
b) $x^2 - x + 2$
c) $x^2 + x + 1$
d) $x^2 + x + 2$

(x) Choose the correct option. The truncation error in Taylor's series after retaining the terms upto order h^p is

a) $E_T^p = \frac{h^p}{(p+1)!} f^{p+1}(\xi)\ (x_p < \xi < x_p + h)$
b) $E_T^p = \frac{h^{p+1}}{(p)!} f^{p+1}(\xi)\ (x_p < \xi < x_p + h)$
c) $E_T^p = \frac{h^{p+1}}{(p+1)!} f^{p+1}(\xi)\ (x_p < \xi < x_p + h)$
d) None of these

(xi) To solve the ODE $3\frac{dy}{dx} + xy^2 = sinx\,, y(0) = 5$ by RK2 method, it is needed to reframe the equation as__. Choose the correct option.

a) $\frac{dy}{dx} = sinx - xy^2\,, y(0) = 5$
b) $\frac{dy}{dx} = \frac{1}{3}(sinx - xy^2)\,, y(0) = 5$
c) $\frac{dy}{dx} = \frac{1}{3}(-cosx - xy^2)\,, y(0) = 5$
d) None of these

(xii) Choose the correct option. The value of y (1) obtained by solving $y' = xy$ using Euler's method with h=0.2 and y (0) =1 is__.

a) 1.5896
b) 1.4593
c) 1.3495
d) 0 .4593

(xiii) Choose the correct interpolation methods that is suitable when the data points are equally spaced.

a) Lagrange interpolation
b) Newton's forward interpolation
c) Newton's divided difference interpolation
d) Cubic spline interpolation

(xiv) Choose the correct option. The degree of the interpolating polynomial passing through 12 distinct data points is at most

a) 7
b) 4
c) 8
d) none of these

(xv) Choose the correct option. Newton's backward interpolation formula is preferred when the required value lies.

a) Near the beginning of the data set
b) Near the middle of the data set
c) Near the end of the data set
d) Outside the data range

Group-B

(Short Answer Type Questions) 3 x 5=15

2. Estimate the product of 171.72, 51.027 and 0.0085 correct up to two decimal places. (3)

3. List the round-off numbers of the following numbers correct up to 4-significant digits: (3)
   a) 5.2056
   b) 0.24062
   c) 0.0055672
   d) 87.268466

4. Estimate the root lying between 2.1 and 2.2 correct up to two decimal places of the equation $x^2 + x - 7 = 0$ using Bisection method. (3)

5. Examine that $\Delta[kf(x)] = k\Delta f(x)$. (3)

6. Evaluate an approximate value of y correct upto two decimal places when $x = 0.1$, if $\frac{dy}{dx} = 3x + 2y$ and $y = 1$ at $x = 0$ taking $h = 0.1$ using 4th order Runge-Kutta method. (3)

OR

Calculate the value of $\int_{1.2}^{1.6} \left(x + \frac{1}{x}\right) dx$, correct upto three significant figures taking two sub-intervals by Simpson's $\frac{1}{3}$rd rule. (3)

Group-C

(Long Answer Type Questions) 5 x 6=30

7. Locate the relative error and percentage error in approximating $\frac{17}{6}$ to 2.8333. (5)

8. Estimate the 2nd iteration value of the root for the equation $x^4 - 12 = 0$ using Newton-Raphson method by taking $x_0 = 1.5$. (5)

9. Solve the following system of equations by Gauss elimination method: (5)

$$3x_1 + x_2 + 2x_3 = 10$$
$$2x_1 + 2x_2 + x_3 = 9$$
$$x_1 + 3x_2 + 2x_3 = 11.$$

10. Calculate $\Delta^2(2x + 1)$, taking $h = 1$. (5)

11. The given differential equation is $\frac{dy}{dx} = x - y, y(0) = 1$ and $h = 0.1$. Evaluate the value of $y(0.2)$ upto 4 decimal places using 2nd order Runge-Kutta method. (5)

12. Evaluate $f(9)$ using Newton's backward interpolation formula, for the following data: (5)

x	0	2	4	6	8	10
$f(x)$	4	21	50	108	415	625

OR

Evaluate the value of $\int_0^5 \frac{dx}{1+x}$ by Trapezoidal rule taking $h = 1$, correct upto one decimal place. (5)

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