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BRAINWARE UNIVERSITY

Term End Examination 2023-2024

Programme – BCA-2022

Course Name – Numerical Methods

Course Code - BCAC303

(Semester III)

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) The error of approximation in Simpson's one-third rule to find $\int_a^b (2x^2 + x + 1)dx$ is __. Identify the correct option.
 - a) 2
 - b) b-a
 - c) 0
 - d) 1
 - (ii) Select the correct option. In Gaussian elimination method, the given system of equations represented by $AX = B$ is converted to another system $UX = Y$ where U is __
 - a) diagonal matrix
 - b) null matrix
 - c) identity matrix
 - d) upper triangular matrix.
 - (iii) Select the correct option. The kind of error when 3.14 is approximate values of π is
 - a) inherent error
 - b) truncation error
 - c) round-off error
 - d) percentage error
 - (iv) Choose the correct option. Newton's backward interpolation formula is used to identify __
 - a) near end
 - b) near central position
 - c) near the beginning
 - d) none of these.
 - (v) Select the correct option. Newton Raphson method is also known as __
 - a) normal method
 - b) tangent method
 - c) parallel method
 - d) none of these.
 - (vi) Select the Newton-Raphson iterative formula for finding the square root of a real number R.
 - a) $x_{i+1} = \frac{x_i}{2}$
 - b) $x_{i+1} = \frac{3x_i}{2}$

- c) $x_{i+1} = \frac{1}{2} \left(x_i + \frac{R}{x_i} \right)$ d) None of these.
- (vii) Choose the correct option. The n^{th} order divided difference of a polynomial of degree n is
- a) n b) constant
 c) zero d) all of these.
- (viii) Identify the rate of convergence of Bisection method.
- a) linear b) quadratic
 c) cubic d) none of these.
- (ix) Simpson's one-third rule is selected only if the number of sub-intervals is ____.
- Choose the correct option
- a) even b) odd
 c) either even or odd d) none of these
- (x) Identify the number of significant figures in 0.03409.
- a) 5 b) 6
 c) 7 d) 4
- (xi) Choose the correct option that is not true.
- a) Trapezoidal formula be a one-point quadrature formula. b) Simpson's one-third formula be a five-point quadrature formula.
 c) Simpson's three-eighth formula be a three-point quadrature formula. d) None of these.
- (xii) Select the correct digit that is not significant of the number 0.025.
- a) 0 b) 2
 c) 5 d) None of these.
- (xiii) Select the number of significant digits in the number 3.0056.
- a) 3 b) 4
 c) 5 d) 2
- (xiv) 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
- (xv) Write the correct option. The Runge-Kutta method is used ____.
- a) to solve an algebraic equation b) to solve a first order ordinary differential equation
 c) to solve a first order partial differential equation d) None of these.

Group-B

(Short Answer Type Questions)

3 x 5=15

2. Define significant digit with an example. (3)
3. Estimate the root lying between 2 and 3 correct to one decimal place of the equation $x^3 - 9x + 1 = 0$ using Bisection method. (3)

4. Convert the following numbers into the round off number correct up to 4-decimal places: (3)
- 56.243827
 - 0.235082
 - 0.560012
 - 40.35856

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5. Construct the forward difference table for the following data: (3)

x	0	1	2	3
$f(x)$	1	2	11	34

6. Evaluate $\int_0^1 \frac{dx}{1+x^2}$ using Trapezoidal rule taking $n = 4$. (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

- Define exact number and approximate number with an example. (5)
- Write the advantages and disadvantages of Regula Falsi method. (5)
- Calculate the value of the following integral by Simpson's one-third rule taking 4 sub-intervals: (5)
 $\int_0^1 \frac{x}{x+1} dx$ correct up to three decimal places.
- 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)
- Show that the root of the equation $x^3 - 2x - 5 = 0$ is 2.09 correct to two decimal places using Newton-Raphson method. (5)
- By applying Runge-Kutta 4th order method evaluate the value of $y(0.1)$ from the differential equation $\frac{dy}{dx} = x + xy^2$, $y(0) = 1$ with step length $h = 0.1$. (5)

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OR

(5)

Evaluate the value of $y(0.4)$ by Milne's predictor corrector method from the equation $\frac{dy}{dx} = xy + y^2$ given that $y(0) = 1, y(0.1) = 1.1169, y(0.2) = 1.2773, y(0.3) = 1.5040$ and $y_4^p = 1.8344$.
