BRAINWARE UNIVERSITY

Term End Examination 2022
Programme – BCA-2019/BCA-2020/BCA-2021
Course Name – Numerical Method
Course Code - GEBS301
(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 30=30

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

(i) The interpolation polynomial defined for a given set of values of x and f(x) is

a) unique b) <p style="text-align: left;">c
c) has degree 4 d) none.

(ii) Matrix inversion method fails to calculate a system of equations if the determinant value of the co-efficient matrix is

a) 0 b) 1
c) 2 d) 3

(iii) Backward substitution method is used to explain a system of equations by

a) Gauss elimination method b) Gauss Jordan method
c) Matrix factorization method d) None of these

(iv) Choose the correct one.
"One of the real roots of $xe^x - 2 = 0$ lies between "

a) (0,1) b) (1,2)
c) (2,3) d) None of these.

(v) Identify the number of significant figures in 0.03409.

a) 5 b) 6
c) 7 d) 4

(vi) Consider Regula-Falsi method, the n-th approximate root (x_n) lies between a_n and b_n, then the next approximate root is

a) $x_{n+1} = a_n - \frac{f(a_n)}{f(a_n)-f(b_n)}(b_n - a_n)$ b) $x_{n+1} = a_n - \frac{f(b_n)}{f(a_n)-f(b_n)}(a_n - b_n)$

c) $x_{n+1} = a_n - \frac{f(a_n)}{f(b_n)-f(a_n)}(b_n - a_n)$ d) $x_{n+1} = a_n + \frac{f(a_n)}{f(a_n)+f(b_n)}(b_n - a_n)$

(vii) Diagonal dominance is must to justify for

a) Gauss-Seidel method b) Gauss Elimination method
c) LU factorization method d) All of these

(viii) Define the number of significant digits in the number 3.0056.

a) 3 b) 4
c) 5 d) 2

(ix) If 'a' be the actual value and 'e' be its estimated value, then define formula for relative error.

a) $\frac{|a-e|}{a}$ b) $\frac{a}{e}$
c) d)

$\frac{|a-e|}{e}$ $\frac{(a-e)}{e}$

(x) Cite the result, 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

(xi) In Newton's forward difference interpolation, identify the value of $s = \frac{x-x_0}{h}$ lies between

a) 1 and 2
b) -1 and 1
c) 0 and ∞
d) 0 and 1

(xii) Indicate "the n-th order divided difference of a polynomial of degree n is"

a) n
b) constant
c) 0
d) All of these.

(xiii) Differentiate which of the following is not correct.

a) The Lagrange's interpolating polynomial exists and unique.
b) Sum of Lagrangian function is 1.
c) The Lagrangian function is invariant under linear transformation.
d) The Lagrangian function is independent on x_i's but depends on y_i's.

(xiv) The n-th divided difference of n degree polynomial $a_0.x^n + a_1.x^{n-1} + a_2.x^{n-2} + \ldots + a_n (a_0 \neq 0)$ is determined as

a) $a_0x + a_1$
b) a_0
c) a_n
d) none of these.

(xv) The technique for computing the value of the function inside the given argument is categorized by

a) interpolation
b) extrapolation
c) partial fraction
d) inverse interpolation

(xvi) In case of Newton Backward Interpolation Formula discriminate which equation is correct to find u?

a) $\frac{(x-x_n)}{h} = u$
b) $\frac{(x+x_n)}{h} = u$
c) $(x - x_n)h = u$
d) $(x - x_n) = u$

(xvii) If h be the fixed value, then first forward difference operator is decided by

a) $\Delta f(x) = f(x+h) - f(x)$
b) $\Delta f(x) = f(x+h) + f(x)$
c) $\Delta f(x) = f(x+h) * f(x)$
d) $\Delta f(x) = f(x) - f(x+h)$

(xviii) Indicate the degree of precision of Trapezoidal rule

a) 1
b) 2
c) 3
d) 5

(xix) Explain Ef(x)=

a) f(x+h)
b) f(x-h)
c) f(x)-f(x-h)
d) f(x)

(xx) In Simpson's one-third rule for solving $\int_a^b f(x)dx$, f(x) is approximated by some

a) line segment
b) parabola
c) circular sector
d) parts of ellipse

(xxi) Simpson's one-third rule can be applied if the number of equal sub-intervals of the interval of integration is

a) odd
b) even
c) there exists no such restrictions.
d) none of these.

(xxii) The degree of approximating polynomial corresponding to Trapezoidal rule and Simpson's one-third rule are classified respectively,

a) 1,1
b) 2,1
c) 1,2
d) 2,2

(xxiii) In Simpson's one-third rule if the interval of integration $[x_0, x_n]$ is reframed into two equal sub-intervals then $\int_{x_0}^{x_2} f(x)dx \cong$

a) $\frac{h}{3}(y_0 + 4y_1 + y_2)$
b) $\frac{h}{3}(y_0 + 2y_1 + y_2)$
c) $\frac{h}{3}(y_0 + 2y_1 + 4y_2)$
d) $\frac{h}{3}(y_0 + y_1 + y_2)$

(xxiv) The predictor-corrector method is determined as

a) Euler's method
b) 4-th order Runge-kutta method
c) Taylor's series method
d) Modified Euler's method

(xxv) Determine an ordinary differential equation of first order and first degree $\frac{dy}{dx} = f(x,y)$ with $y(x_0) = y_0$

a) An IVP
b) A BVP
c) Integro differential equation
d) none of these.

(xxvi) Infer the result after rounding off to three places of decimals of the number15.23186.

a) 15.231
b) 15.232
c) 15.241
d) 15.2

(xxvii) Rearrange the result after rounding off to three places of decimals of the number 7.16528

a) 7.17
b) 7.16
c) 7.2
d) 7.165

(xxviii) Examine one of the roots of the equation $x^2 + 2x - 2 = 0$ lies between

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

(xxix) Recall, the order of convergence of Newton-Raphson method is

a) 3
b) 2
c) 1
d) none of these.

(xxx) Recall, to solve the system of equations by Gaussian elimination method, A is transformed to a

a) lower triangular matrix
b) upper triangular matrix
c) diagonal matrix
d) none of these.

Group-B

(Multiple Choice Type Question) 3 x 10=30

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

(i) For an equation like $x^2 = 0$, a root exists at x=0. The Bisection method cannot be administered to solve this equation in spite of the root existing at x=0 because the function $f(x) = x^2$

a) is a polynomial
b) has repeated roots at x=0
c) is always non-negative
d) slope is zero at x=0

(ii) Develop 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.

(iii) Examine the condition of convergence of Newton-Raphson method when applied to an equation f(x)=0 in an interval is

a) $f'(x) \neq 0$
b) $|f'(x)| < 1$

c) $\{f'(x)\}^2 > |f(x)f''(x)|$ d) $\{f''(x)\}^2 > |f(x)f'(x)|$

(iv) Analyse error in one step formula of Simpson's one-third rule in $\int_a^b f(x)dx$

a) $\frac{-h^5}{90} f^{iv}(c) a < c < b$ b) $\frac{-h^5}{90} f^{v}(c) a < c < b$

c) $\frac{-h^4}{90} f^{iv}(c) a < c < b$ d) $\frac{-h^3}{90} f''(c) a < c < b$

(v) In Trapezoidal rule for finding the approximate value of $\int_{12}^{24} f(x)dx$, then calculate error. (when the number of sub-interval is 12)

a) $-(\frac{1}{12})f''(\zeta)$ where $12 < \zeta < 24$ b) $-2f''(\zeta)$ where $12 < \zeta < 24$

c) $f'(\zeta)$ where $12 < \zeta < 24$ d) none

(vi) Let $f(0) = 1.76, f(1) = 4.24$ and then evaluate the Trapezoidal rule gives approximate value of $\int_0^1 f(x)dx$

a) 6 b) 3

c) 3.12 d) 3.98

(vii) The second order Runge-Kutta method is applied to the initial value problem $y' = -y, y(0) = y_0$ with step-size h. Then estimate y(h) .

a) $y_0(h-1)^2$ b) $\frac{y_0}{2}(h^2 - 2h + 2)$

c) $\frac{y_0}{6}(h^2 - 2h + 2)$ d) $y_0\left(1 - h + \frac{h^2}{2} + \frac{h^3}{6}\right)$

(viii) Select the iteration formula of Modified Euler's method

a) $y_r^{(n)} = y_{r-1} + \frac{h}{2}[f(x_{r-1}, y_{r-1}) + f(x_r, y_r^{n-1})]$ b) $y_r^{(n+1)} = y_{r-1} + \frac{h}{2}[f(x_{r-1}, y_{r-1}) + f(x_r, y_r^{n-1})]$

c) $y_r^{(n)} = y_{r-1} + \frac{h}{2}[f(x_{r-1}, y_{r-1}) + f(x_r, y_r^{n})]$ d) none of these

(ix) Using third order Taylor's series expansion, evaluate the value of y(1.1) from the IVP $y' = xy, y(1.0) = 2$ is

a) 2.221 b) 2.311

c) 2.411 d) none of these

(x) Estimate the value of k_1 by using RK2 method from the ODE $yy' = y^2 - x, y(0) = 2, h = 0.2$ is

a) 0.4133 b) 0.46333

c) 0.5123 d) none of these

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